OPERATING MANUAL

930 A
COMMUNICATIONS TEST SET

SAGE
INSTRUMENTS

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OPERATING MANUAL

930A
COMMUNICATIONS TEST SET

831 761 1000

SAGE INSTRUMENTS

WARRANTY

The SAGE Instruments 930A is warranted to be free from defects in materials or workmanship for a period of one year from the date of shipment. During the warranty period, SAGE will, at its option, either repair or replace products which prove to be defective at SAGE's expense.

Any repairs for damages from accident, misuse, shipment in other than approved packaging, or improper repair by other than SAGE Instruments' technicians or their authorized service facilities are not covered by this warranty. All out of warranty repairs will be done at the customer's expense based upon time and materials.

SAGE Instruments warrants that firmware provided for the 930A will execute its programming instructions when properly installed. SAGE does not warrant the operation of the instrument to be continuous or error free.
If improper operation of the Model 930A is suspected, contact SAGE Instruments at (408) 761-1000. Upon verification of problem with Customer Service, a Returned Material Authorization number will be issued for the instrument.

EXCLUSIVE REMEDIES

The remedies provided herein are the **original buyer's** sole and exclusive remedies. SAGE Instruments is not liable for consequential damages or damages to any party other than the **original buyer**. SAGE Instruments specifically disclaims any implied warranty of merchantability or fitness for a particular purpose. No other warranty is expressed or implied.

SHIPPING INSTRUCTIONS

After obtaining return material authorization number, ship the Model 930A, in its original container, postage prepaid, to:

SAGE INSTRUMENTS
240 Airport Blvd.
Freedom, CA 95019-2614
(408) 761-1000
ATTN: REPAIR

Include a detailed description of the problem and the conditions and circumstances under which the symptoms occurred. **IF THE ORIGINAL PACKAGING (OR APPROVED EQUIVALENT) IS NOT USED, THE WARRANTY WILL BE VOID.**

SAGE INSTRUMENTS

930A COMMUNICATIONS TEST SET OPERATING MANUAL

Rev. 4.0
10/01/94

SOFTWARE VERSIONS 4.05 AND HIGHER

831 761 1000

SAGE INSTRUMENTS
240 AIRPORT BOULEVARD
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1 INSTALLATION AND GETTING STARTED

1-0 INTRODUCTION

This section provides information regarding initial inspection, preparation for operation, power requirements, storage and shipment.

1-1 CONTACTING SAGE INSTRUMENTS

To contact Sage Instruments in writing, send correspondence to:

Sage Instruments, Inc.
240 Airport Blvd.
Freedom, CA 95019-2614

Our Technical Support and Customer Service Departments may be reached by calling (408) 761-1000, M-F, 9 a.m. to 5 p.m., Pacific Time. Be sure to specify *Model 930A* when asking for technical support.

1-2 INITIAL INSPECTION

Check the shipping carton for any visible signs of damage. Carefully unpack and remove the 930A from the shipping container. If the 930A is received in damaged condition, file a claim with the carrier immediately. Mail a copy of the claim to Sage Instruments.

The following items should be included in the shipping container:

1. 930A Communications Test Set.
2. 930A Operating Manual (this document).
3. AC power cord.

Accessories may or may not be shipped in the same container as the 930A, depending upon their size. Check the shipping invoice carefully against the contents received in all boxes.

1-3 PREPARATIONS FOR USE

The 930A is designed to operate on 115 VAC, 60 Hz power or when equipped, 220 VAC 50 Hz. Connection to a power source other than this will cause damage to the 930A.

Do not interrupt the protective (ground) conductor (inside or outside the instrument), or disconnect the protective earth terminal as this can make the instrument an electrical shock hazard.

Calibration on the 930A should be performed at least once a year, and must be performed after replacing any circuit boards. Before calibrating, call Sage Instruments' Customer Service Department and ask for a 930A Calibration Manual.

1-4 OPERATING ENVIRONMENT

The 930A may be operated in temperatures from 0° C to 50° C (+32° F to +122° F) and will operate in environments with 10–90% relative humidity, non-condensing, at +40° C (104° F).

1-5 STORAGE AND SHIPMENT

The instrument may be stored and shipped within the following environmental limits:

Temperature	-40 to +70° C
Humidity	Up to 90% Relative @ +65° C

If possible, retain the original shipping container and packing materials. In the event that the 930A must be returned to Sage Instruments and the original container is no longer available, the following general instructions should be used for repackaging the instrument with commercially available materials.

1. Call Sage Instruments for a Return Material Authorization (RMA) number.
2. Include your return address, serial number, name of your technical contact at Sage Instruments, and the RMA number inside the box.
3. Use a double-walled carton of at least 350 pound test material. Dimensions must be 21"L x 19.5"W x 14.25"H to provide space for shock-absorbing material.
4. Use a 3-4" layer of shock absorbing foam material (do not use "popcorn" foam) on the top, bottom and all sides of the instrument. Protect the front panel with cardboard.
5. Seal the container securely.
6. Mark the container **FRAGILE**. Write the RMA number on the outside of the box (*not* in the address location).

THE WARRANTY WILL BE VOIDED IF THE 930A IS RETURNED IMPROPERLY PACKAGED!

1-6 PHYSICAL DESCRIPTION

The 930A measures 5.79" H x 14.33" W x 14.25" D. A convenient carrying handle extends 1.25" from the right side of the instrument case. Two smaller carrying handles extend 1.25" from the front panel of the unit. Four rubber feet extend 0.5" from the left side of the case. Four large plastic feet extend 1" from the rear panel of the unit permitting the operator to set the unit on end when performing tests at the DSX jack field. Four additional feet are attached to one side of the 930A for convenience. For ease of viewing, the 930A is equipped with a pivot brace under the unit. This raises the front of the unit three inches when extended.

The front panel shown in **Figure 1-1** measures 5.25" H x 13.5" W. It contains 37 keys, 11 LEDs, a speaker grill, a volume control knob, a hookswitch, a 2.25" x 3.25" configurator panel which contains the input/output connectors, a 40 character alphanumeric Fluorescent Indicator Panel (FIP), connectors for a headset, telephone handset, and two carrying handles. Refer to **Section 2, Front Panel Operation** for detailed information regarding the functionality of the front panel keys.

The configurator panel is located in the lower right side of the front panel as shown in **Figure 1-1**. Depending upon which configurator has been ordered, a combination of 310 jacks, bantam jacks, 5-way binding posts, or a 15-pin subminiature D-type connector will be installed. Refer to **Section 2-9** and **Figure 2-9** for more information on configuration panels.

Figure 1-1
930A COMMUNICATIONS TEST SET

1-6.1 AC Rear Panel

The 930A rear panel measures 5" x 13.5". The AC powered 930A contains the following:

ON/OFF Switch
Recessed connector for 3-prong power cord
Fuse Holder
Fan Guard
Ground Lug (Binding Post)
25 pin RS-232C D-type connector (optional)
Four plastic rubber feet

Refer to **Section 1-7, DC Rear Panel** for more information on DC powered 930As.

1-6.1.1 ON/OFF Switch

The ON/OFF switch controls power to the 930A. It is located at the top center of the rear panel. Refer to **Figure 1-2**.

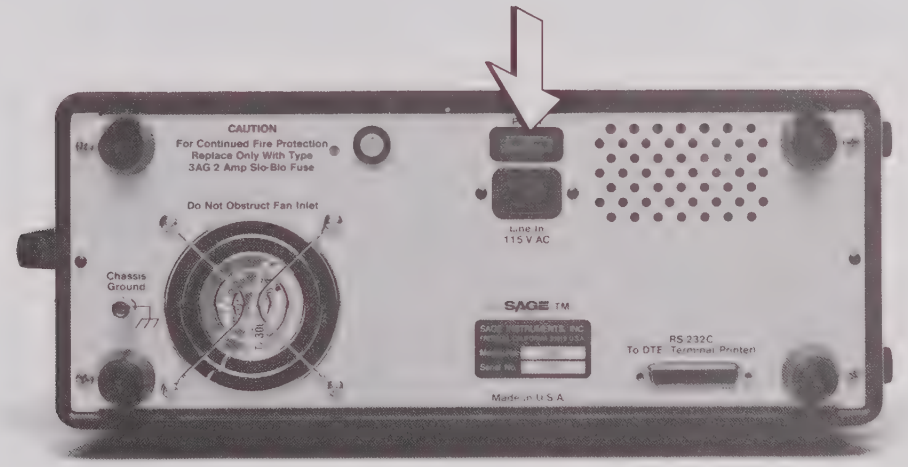


Figure 1-2
ON/OFF SWITCH

1-6.1.2 AC Power Connector

The AC power connection is located directly beneath the ON/OFF switch and is intended for use only with the power cord supplied with the unit. Refer to **Figure 1-3**.

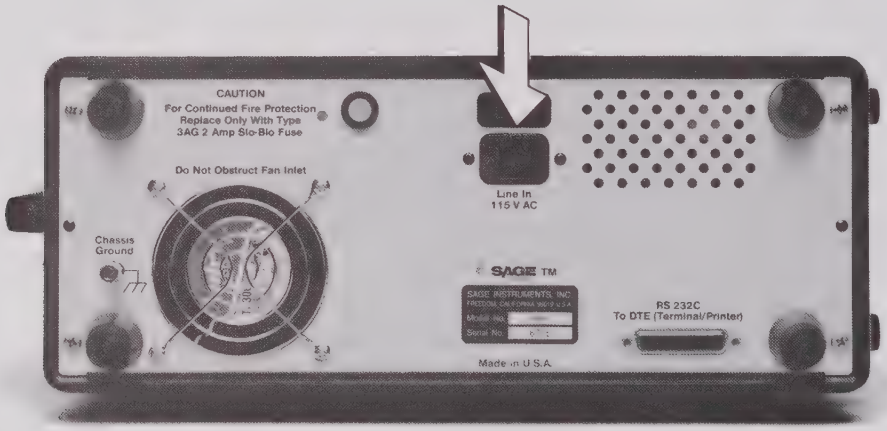


Figure 1-3
AC POWER CONNECTOR

1-6.1.3 Fuse Holder

The fuse holder is spring loaded. To gain access to the fuse, insert a flat blade screwdriver into the fuse holder slot and make a 1/4 turn counterclockwise. The fuse is a 2-amp Slo-Blo. If a power surge causes the fuse to fail, be sure to replace it *only* with a fuse of the same rating, and *only* after determining that the condition which caused the failure no longer exists. Refer to **Figure 1-4**.

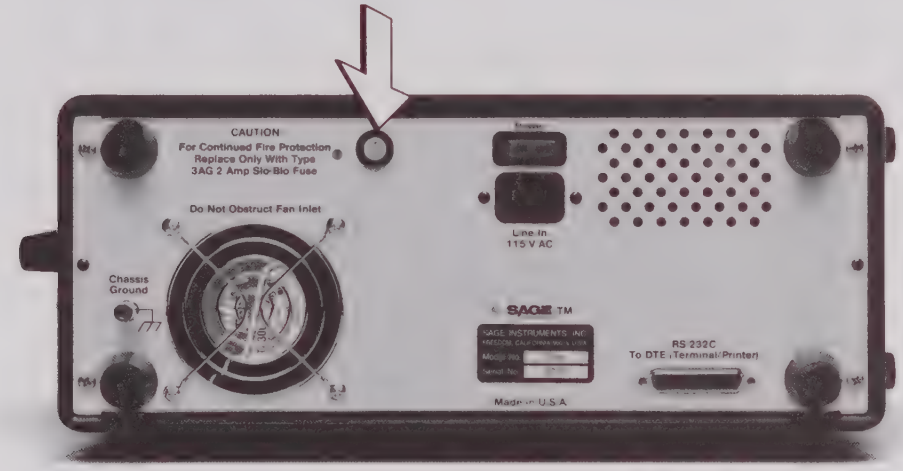


Figure 1-4
FUSE HOLDER

1-6.1.4 Fan Guard

The fan guard allows warm air to exit from the 930A. Do not block the air intake, place it adjacent to a heating duct, or operate the unit standing on its rear panel on a thick carpet. Refer to **Figure 1-5**.

DO NOT BLOCK THE HOLES IN THE UPPER RIGHT CORNER OR DAMAGE TO THE 930A WILL RESULT. THESE HOLES ALLOW WARM AIR TO EXIT FROM THE 930A.

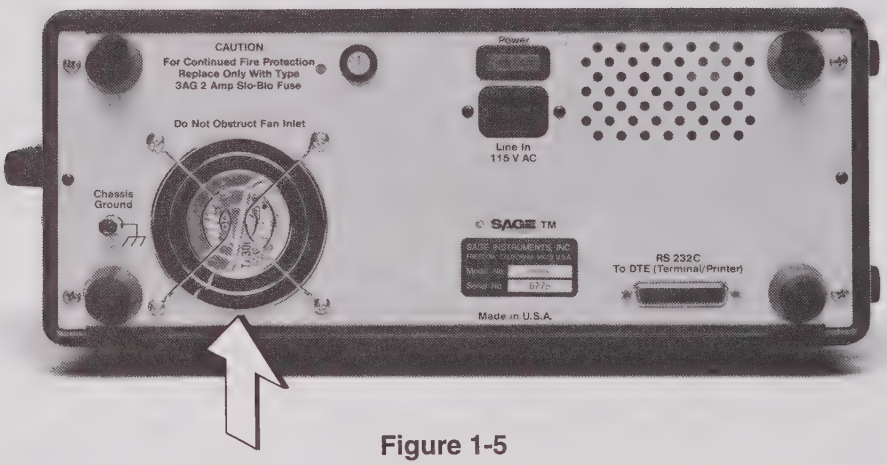


Figure 1-5
FAN GUARD

1-6.1.5 Ground Lug

The ground lug located at the lower left edge of the rear panel provides ready access to the 930A's case ground for safety purposes. Refer to **Figure 1-6**.

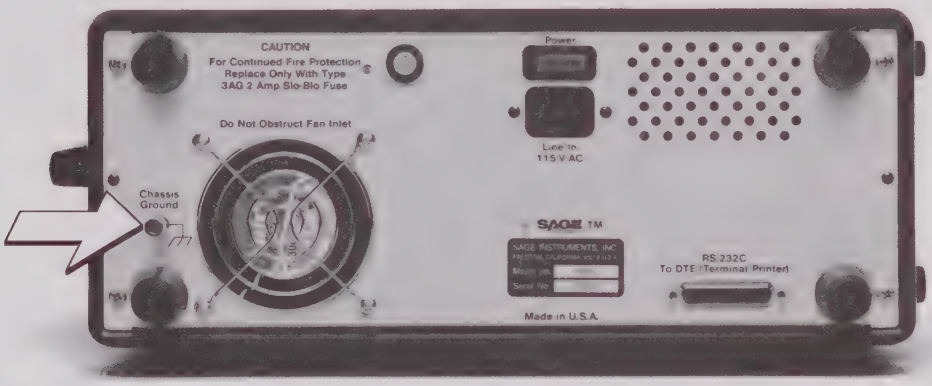


Figure 1-6
GROUND LUG

1-6.1.6 RS-232C Connector

The RS-232C connector (for use with *Purchased Option 930A-10C, Real Time Clock*) is located at the lower right side of the rear panel. The connector is configured internally as Data Communication Equipment (DCE). This enables direct connection to Data Terminal Equipment (DTE) such as terminals or printers. Connection to a modem (DCE), however, must be made through a "null modem" adapter cable. Refer to **Figure 1-7**. See **Section 7, Remote Control** for more information.

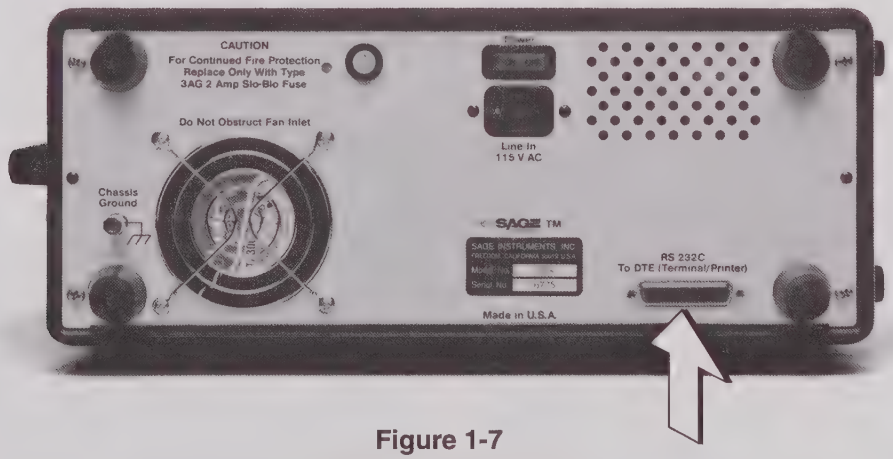


Figure 1-7
RS-232 CONNECTOR

1-6.1.7 Feet

The four rear panel feet will support the 930A on a level surface. Four additional feet are located on one side of the 930A. *Do not place an operating 930A on thick carpets or on surfaces that are thick with dust; access to the fan guard may be blocked.*

> ***The rear panel is held in place by four screws. DO NOT REMOVE THEM. Access to the interior of the 930A is provided by removing the top cover.***

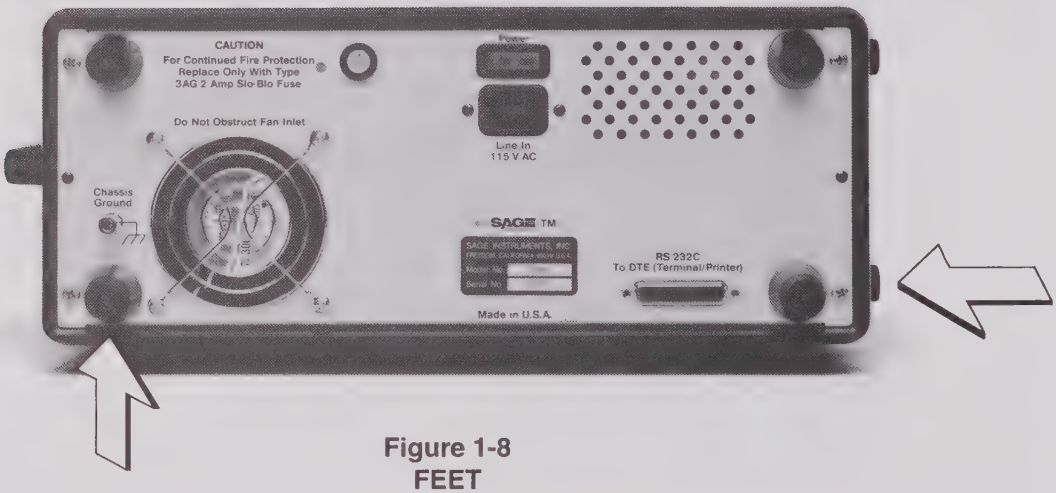


Figure 1-8
FEET

1-6.1.8 Handles

The 930A has one handle on the right side, and 2 smaller handles attached to the front panel for proper lifting and carrying.

1-6.1.9 Serial Tag

Your product serial number and model number are located on a serial tag at the bottom-center of the rear panel. Refer to **Figure 1-9**.

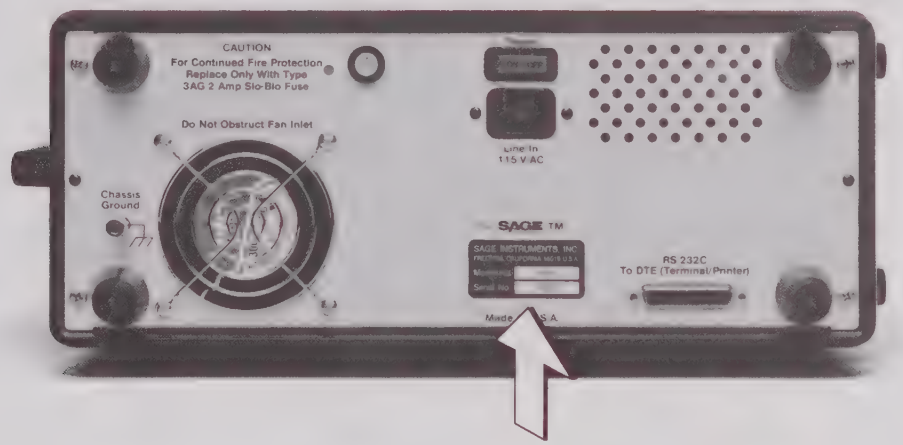


Figure 1-9
SERIAL TAG

1-7 DC REAR PANEL

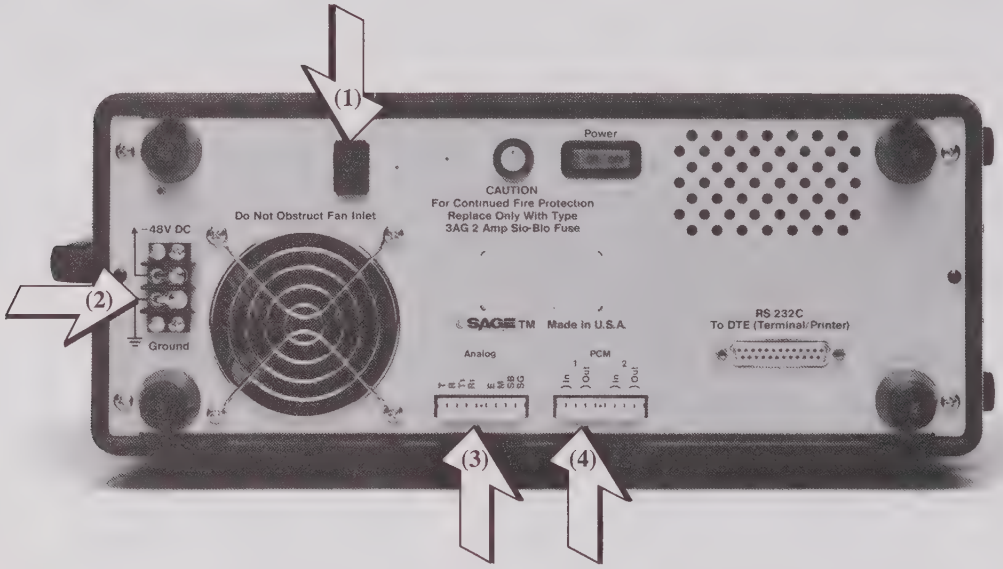


Figure 1-10
DC REAR PANEL

The DC powered 930A contains the following:

ON/OFF Switch
Fuse Holder
Fan Guard
2-Terminal Barrier Terminal Block
25-pin RS-232C D-type connector (optional)
Analog/PCM 9-pin Connectors (optional)
Remote Audio RJ-11 Connector (optional)
Four plastic rubber feet

(1) Remote Audio jack
(requires *Purchased Option 930A-47, Remote Audio Monitor*)

(2) Barrier Terminal Block

(3) Analog Rear Panel Access
(requires *Purchased Option 930A-16, Analog Rear Panel Access*)

(4) PCM Rear Panel Access
(requires *Purchased Option 930A-08E/09E, DS-1 PCM/ESF capability, 930A-16, Analog Rear Panel Access, and 930A-31, Digital Rear Panel Access*)

1-8 SUPPLYING POWER

Power-on the 930A using the red rocker switch located at the top-middle of the rear panel. When first powered up, the 930A will run through a memory check and then briefly display the following:

N.NN is the version of software present in the unit. Note the condition of the LEDs on the front panel. If an error has been detected by the built-in self test, all of the LEDs will be lit. This is an abnormal condition indicating a possible malfunction of the test set. Turn the 930A off and perform a "cold-boot" as described in the following section.

1-9 "COLD-BOOTING" THE 930A

There are two types of cold-booting you can perform on the 930A. One is a complete hardware cold-boot with procedural directions below. The other is a software cold-boot and has been added for the convenience of persons writing remote control software. The software cold-boot is performed by using the **Option Menu** function key and selecting **`OPTION MENU #: 92 SOFTWARE COLD-BOOT`**.

To perform a hardware cold-boot:

1. Turn off the 930A.
2. Hold down the Trunk Type function key. The function keys are located on the left of the front panel. (Refer to **Section 2, Front Panel Operation** and **Section 3, Function Key Operation** for more specific information on function keys.)
3. Holding down the function key, turn on the 930A. Do not release the function key until the display has scrolled all the way across the screen.

> ⚠ *A successful cold-boot will erase any previously stored settings or test results and restore factory defaults to all menus.*

After it completes its memory test, the 930A will come up to the default **Trunk Type** display which is shown below:

> ⚠ *If you have purchased your 930A without an analog interface (T1 only), your default Trunk Type is PCM.*

If the 930A does not come up to the default Trunk Type, a cold-boot was not achieved. Call Sage Instruments' Customer Service for assistance.

2 FRONT PANEL OPERATION

2-0 INTRODUCTION

This section provides information regarding operation of the front panel keys, switches and test cord connections.

2-1 FRONT PANEL LAYOUT

The front panel layout with the locations of the controls, indicators, and connectors is shown below in **Figure 2-1**. The following pages describe each function.

Figure 2-1
930A FRONT PANEL

2-2 SPEAKER AND VOLUME CONTROL

The speaker and volume control are located on the far left of the 930A front panel as shown in **Figure 2-2**:

Figure 2-2
SPEAKER AND VOLUME CONTROL

2-3 TELSET JACKS

The **TelSet** jacks are located on the bottom, far left of the 930A front panel as shown in **Figure 2-3**. They are provided as an external telephone monitor. The "cufflinks" located directly above the **TelSet** jacks are for use with a telephone lineman's test set (external butt-in set).

Figure 2-3
TELSET JACKS

2-4 FUNCTION KEYS

The function keys consist of seven black keys which control the different functions of the 930A. Refer to **Section 3, Function Key Operation** for specific information on each function key. They are located to the left of the FIP as shown in **Figure 2-4**:

Figure 2-4
FUNCTION KEYS

2-5 NUMERIC KEYPAD

The numeric keypad consists of 16 white keys which operate like a telephone keypad. They are located beneath the display as shown in **Figure 2-5** :

Figure 2-5
NUMERIC KEYPAD

When entering numerical data such as Tone Frequency or Level, you will generally be prompted by a flashing cursor. Any leading blanks (digits expected but not entered) are treated as zeros. The sign of a number, such as tone level, may be changed by pressing the **D +/-** (change sign key) key.

2-6 SPECIAL FUNCTION KEYS

The Special Function keys are the six light gray keys located to the right of the numeric keypad as shown in **Figure 2-6**:

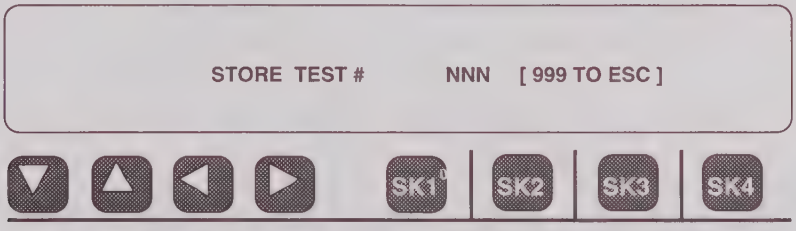
Figure 2-6
SPECIAL FUNCTION KEYS

2-6.1 STO Key

The **STO** key is used to store a particular test set-up, outpulse sequence, digit string, or any **Option Menu** number such as `OPTION MENU #: 4 DIGIT RECEIVER`, into one of 998 register locations (`01` to `998`). This is done by pressing the **STO** key, entering the number corresponding to the register location desired, and then pressing the **ENT** key.

The 930A will retain what has been stored in its memory until the lithium battery on its CPU runs down, or you overwrite that memory location with a new program. This information is lost if a cold-boot is performed.

The following display appears after the **STO** key is pressed:



`NNN` in the display is the number of the storage location.

The 930A automatically increments the storage location after each entry. Press **STO** and **ENT** to store in consecutive memories.

Storing something new in a memory location automatically replaces the previous contents. A general description of the stored parameters for various test situations follows:

In **Trunk Type**: All of the Trunk Type parameters listed on the display are saved exactly as they are shown. For PCM trunks this includes the undisplayed parameters set in the submenus.

In **Dial/Ring**: The displayed digits, the outpulsing mode (MF, DTMF, or DP), and any modifications made in **OPTION MENU #: 1 MODIFY DIAL/RING** are saved. If a digit string has been stored with modifications, the outpulsing label (MF, DTMF, or DP) will be preceded by the ">" character.

In **Return Loss**: All of the displayed parameters, including signal type, echo-suppress tone, and transhybrid loss are saved.

In **Send Tone**: The level, frequency, and Tone On/Tone Off are saved.

In **Measure Tone**: The relative zero level is saved.

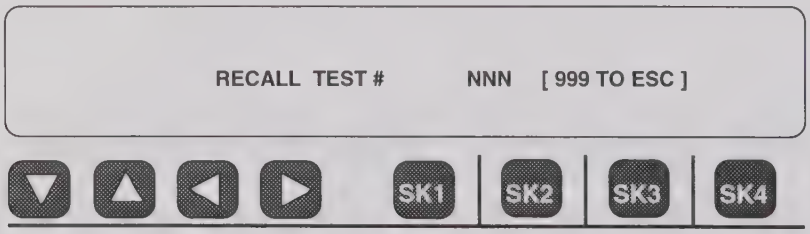
In **Measure Noise**: The filter type, balanced or noise-to-ground measurement, and relative zero are saved.

> ! *In any measurement function, it is the test set-up (parameters) which is saved, not the current measurements results.*

In **OPTION MENU**, exit to the Option Menu by pressing the **Option Menu** key. From the main Option Menu #: display, use the **STO** key to save all parameters specified within that option. The only exception to this is **OPTION MENU #: 1 MODIFY DIAL/RING**. Parameters set in this Option Menu #: are considered to be undisplayed parameters under the Dial/Ring function. See **Section 3, Function Key Operation** for a description of the **Dial/Ring** function key.

2-6.2 RCL Key

The **RCL** key is used to recall a test set-up or other parameters which have been stored in a particular register. Pressing the **RCL** key will bring up the following display on the 930A:



Use the numeric keypad to input the storage location number (between **00** and **998**) of the desired test set-up. Press **ENT** or a softkey to recall the set-up stored in that location.

2-6.3 RCL NXT Key

Pressing the **RCL NXT** key after pressing the **RCL** key will display the set-up in the storage location following the currently displayed location. Each time **RCL NXT** is selected, the storage location will increment by one. If a storage location has no information, the 930A will display **LOCATION [NN] IS EMPTY**.

2-6.4 ENT Key

The 930A's **ENT** key enters information into the 930A. Once the correct numeric data has been input for a particular test or program, press **ENT** and the data is accepted. In some cases, you cannot advance to the next operation until you have completed your data entry by pressing the **ENT** key.

If the 930A is in Printer Remote mode or Compter Remote mode with the proper connections, pressing **ENT** will also cause a printout of the current display if a printer is connected to the 930A in Printer Remote mode.

2-6.5 CLR Key

The **CLR** key is used to clear or initialize sequences and allow new entries to be made. It is not used to clear a numeric value to zero. This is done by entering a zero. The **CLR** key is used to clear sequences of variable length, such as a string of digits to be outpulsed in the **DIAL/RING** mode.

2-6.6 HELP Key

The **HELP** key is provided to assist you in operating the 930A. Pressing the **HELP** key displays a series of screens which lead you step-by-step through the function currently on the display. Within each **HELP** menu, the softkeys control each selection. As each screen appears, choose the correct parameter for your test by pressing the softkey directly under the displayed value.

2-7 HOOKSWITCH AND SUPERVISION LEDs

The chrome switch located to the right of the Special Function keys is the hookswitch. The four LEDs above the hookswitch are the supervision lamps.

Figure 2-7
HOOKSWITCH AND SUPERVISION LEDs

The hookswitch controls whether the 930A is on-hook or off-hook. On 2- and 4-wire analog trunks it also engages the holding coils. (To outpulse digits, send tones, etc., the 930A must be off-hook in most cases.)

The supervision LEDs show the status of the originate (**ORIG**) and Terminate (**TERM**) ends of the circuit.

In some Trunk Types and directions (such as **LOOP, CONTACT**), the 930A must be off-hook to send tones and outpulse digits.

The 930A is the originating end of the circuit when sending digits; it is the terminating end when receiving digits. In certain applications it is less obvious which end is originating and which is terminating. The lamps are provided as a convenience to the user in these applications.

> *If the 930A has been placed in a **REMOTE CONTROL** mode, the hookswitch is inoperative unless **STANDBY** mode is selected, taking the 930A out of Remote Control. Refer to **Section 7, Remote Control.***

The operation of the hookswitch on PCM trunks is described in **Section 5, PCM Operation**.

2-8 TEST CORDS AND FRONT PANEL JACKS

Figure 2-8
TEST CORDS AND FRONT PANEL JACKS

Several types of configurator panels are available depending upon the options installed in the 930A. Although the jacks may be located in different positions, a jack labeled **TR** or **PCM IN 1** for example, is connected and used in the same way on all configurator panels. Refer to **Section 2-9** for a description of the available panels.

A 2-wire loop start, ground start, or reverse battery trunk is connected to the 930A at the type 310 jack labeled **TR**.

A 4-wire trunk requires connections to the type 310 jacks labeled **TR** and **T1R1**. If the trunk is an E&M trunk, the E&M lead test cord must be connected to the type 310 jack labeled **E/M** for Type I. If E&M Types II through IV are being tested, the signal battery/signal ground leads must be connected to the type 310 jack labeled **SB/SG**.

If a T1 (DS-1) carrier circuit is to be tested, the tiny telephone (bantam) jacks labeled **PCM IN 1** and **PCM OUT 1** are used for single-direction testing. This requires *Purchased Option 930A-08E*. For dual-direction drop and insert testing, **PCM IN 2** and **PCM OUT 2** will also be used. Dual direction operation requires the 930A to be equipped with *Purchased Option 930A-09E*. See **Section 5, PCM Operation** for more information.

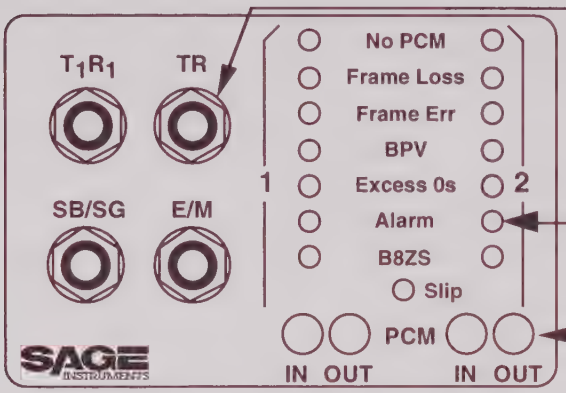
2-9 ANNUNCIATOR PANELS

The "LED Annunciator" is the standard configurator for PCM units. LEDs indicate status and errors on the T1 lines.

The "Analog Configurator" is used in 930As intended for entirely analog operation and have no PCM options. The 310-type jacks are for the analog input/output and are labeled **SB/SG** (Signal Battery/Signal Ground), **E/M** (The "E"- and "M"-leads), **T/R** (Tip and Ring), and **T_1/R_1** (Tip1 and Ring1). The **E/M** and **SB/SG** leads are used for E&M signaling. **TR** and **T_1R_1** are used by all 4–wire analog trunks. All 2-wire signaling and transmission is done over **TR**.

The "310 A/P Configurator" is intended for use in those units which have both analog and digital (T1 PCM) capability. (*Purchased Option 930A-08E* or *-09E* has been installed.) Both sets of jacks are 310-style and they are labeled **PCM1 IN, PCM1 OUT, PCM2 IN, PCM2 OUT, SB/SG** (Signal Battery/Signal Ground), **E/M** (The "E"- and "M"-leads), **T/R** (Tip and Ring), and **T_1/R_1** (Tip1 and Ring1).

The "Universal Configurator" is intended for use with analog/digital trunks and also has a 15-pin subminiature D-type connector for use with the Sage Instruments 114A Supplementary Trunk Test Panel Adapter. The 15-pin D connector is currently not connected to a T1 interface. To order this configurator without Option 930A-14, specify Part Number 7930-0390-01.

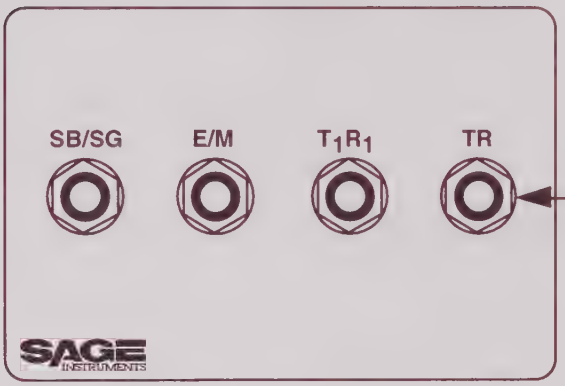


Type "310" jack for Metallic (Analog) Trunks

LEDs for T1 PCM Monitor

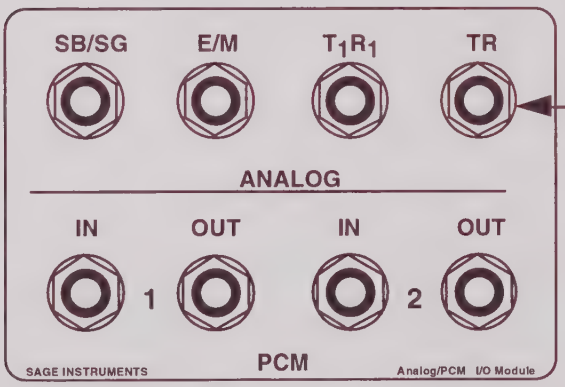
"Bantam" jacks for T1 PCM Trunks

The **A/P Annunciator** is the standard configurator for analog and PCM units. If you are ordering Option 930A-14 (STTP/LTTP 1/1A ESS), see the description for the Universal Configurator below.



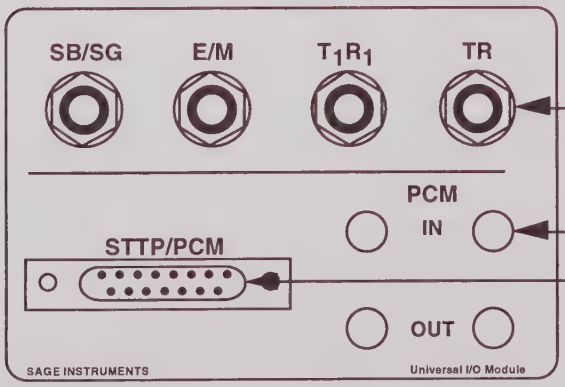
Type "310" jack for Metallic (Analog) Trunks

The **Analog Configurator** is the standard configurator for analog only units unless Option 930A-14 (STTP/LTTP 1/1A ESS) has been purchased, or the 310/AP Configurator has been specified.



Type "310" jack for Metallic (Analog) Trunks

The **310 A/P Configurator** is available for customers not using "Bantam" jacks for PCM operation. To order this configurator, specify Part Number 7930-0290-01.



Type "310" jack for Metallic (Analog) Trunks

"Bantam" jacks for T1 PCM Trunks

15-pin D-connector

The **Universal Configurator** is provided when Option 930A-14 (STTP/LTTP 1/1A ESS) is purchased. The 15-pin D-connector is *not* a T1 interface. To order this configurator without Option 930A-14, specify Part Number 7930-0390-01.

Figure 2-8
CONFIGURATOR PANELS

3 Function Key Operation

3-0 INTRODUCTION

This section provides information on the operation of each function key, located on the left of the front panel. For information on the Option Menu function key, refer to **Section 6, Option Menu Numbers**.

3-1 TRUNK TYPE FUNCTION KEY

When power is first applied to the 930A it will default to the last-used configuration under the **Trunk Type** function key. A typical display is shown below:

Use the Up/Down arrow keys or softkey 1 to scroll through the available Trunk Types. The following list contains the available Trunk Types:

NORMAL LOOP
REVERSE LOOP
NORMAL GND-ST (ground start)
REVERSE GND-ST
E&MI-V
OPTIONAL TYPES: **PCM** **SF** **WIDEBAND**

Under each Trunk Type, the 930A may be used in **BRIDGE** or **TERM** (terminate) mode. Softkey 2 toggles these parameters.

For **LOOP** and **GND-ST** Trunk Types, the 930A can provide either **BATTERY** or **CONTACT**. In **E&M** Trunk Type, the 930A can either **SEND-E** or **SEND-M**. Softkey 3 toggles these parameters.

The 930A can provide **2W 150-1200** Ohm or **4W 150-1200** Ohm impedances. Changing Trunk Types or changing from 2W to 4W operation automatically places the 930A in the **BRIDGE** mode. In this mode, the 930A does not send supervision. The supervision lamp marked **ORIG** shows the end of the circuit which the 930A would simulate if it were in **TERM** mode.

For specific information on using the Trunk Type function key in **PCM** mode, see **Section 5, PCM Operation**.

For specific information on using the Trunk Type function key in analog mode, including **SF** (Superframe) or **WIDEBAND**, see **Section 4, Analog Operation**.

3-2 DIAL/RING FUNCTION KEY

To operate the 930A in Dial/Ring mode, you must know the number you want to call and whether the digits are to be MF, DTMF or DP. If you want to talk on the trunk, you will also need a lineman's butt-in set or a telSet such as the type used at Central Office test panels.

Place the 930A front panel hookswitch **On Hook**. Press the **Dial/Ring** function key. You will see a display similar to the following:

Use softkey 3 to scroll through the outpulsing modes. The available modes are **MF** (multi-frequency), **DTMF** (dual tone multi-frequency) **DP** (dial pulse) and **RING**. **DP** is valid only in **CONTACT** mode; it is not available when the 930A is simulating a Central Office (supplying battery). **RING** is only available with *Purchased Option 930A-13 REN-3* Load installed and is only valid when supplying battery.

Changing the outpulsing mode will clear the display of any digit sequence.

Enter the digits using the keypad. The Left arrow key is used to insert a one second pause into a digit sequence and appears on the display as a "**-**" between digits, as in **9-1-408761-1000**.

Enter the digits and go off-hook by putting the hookswitch in the **Off Hook** position. You may also go off-hook first, in which case the digits are outpulsed as you dial.

Press softkey 2 under **RPT?** to have the 930A send the digits. The display will change to **RPT!.**

> *When sending MF digits, first enter a **KP** (key pulse), enter the numbers, and end with an **ST** (stop pulse). For example, an MF digit string could be **KP004155551212ST**.*

Softkey 1 is inactive unless the 930A is in the **RING** mode (*Purchased Option 930A-13* is installed). In this case, press softkey 1 under **MANUAL** to send ringing until the softkey is released.

Softkey 4 is inactive. Here, the 930A indicates which leads are in use for outpulsing: (**TR, T1R1, SEND-E, SEND-M, PCM 1** or **PCM 2**).

The **CLR** key clears the display and erases any "remembered" digits.

3-2.1 Store and Recall Phone Numbers

To store frequently used phone numbers for future recall and outpulsing, press the **STO** key to save the currently displayed digit sequence, its outpulsing mode (MF, DTMF, or DP), and any modifications which may have been made. The parameters may be stored in any of the 998 register locations (numbered from **01** to **998**).

3-2.1.1 Example: STO & RCL in Dial/Ring

As an example, store the unmodified DTMF sequence, shown in the following display, in register location 17.

To store this number in register location 17, press the **STO** key, use the numeric keypad to select **17** and press the **ENT** key.

The procedure is the same for storing any phone number in any register location. Enter the desired memory location in place of the 17 used above. To recall the digit sequence, select the **RCL** key, press **17** and the **ENT** key.

As an example, for IDDD applications in which a CCITT No. 5 MF sequence is being outpulsed, the required KP2 pulse is equivalent to the **ST2P** pulse located on the **B** key on the 930A numeric keypad. Such an IDDD MF sequence would appear as **ST2P11071738945ST**.

3-2.2 Transmission Level Point (TLP) Compensation

Changing the TLP affects the level of the dialed digits being sent from the 930A. Outpulsed digits are normally sent at 7 dBm per tone below the TLP. For example, at a 0 dB TLP the 930A sends individual MF and DTMF tones at -7.0 dBm. At a -16 dB TLP, the 930A sends the tones at -23 dBm.

A detailed discussion of the TLP adjustment is located in **Section 6-30** and is accessed through **OPTION MENU #: 30 ADJUST TLP**.

3-3 RETURN LOSS FUNCTION KEY

The 930A can measure return loss on 2W or 4W trunks. Measurements in **2W 135** Ohm or **1200** Ohm impedances are not available.

After completing the initial Trunk Type set-up, press the **Return Loss** function key and a display similar to the following will appear:

Use softkey 1 to select Echo Return Loss (**ERL**), Singing Low (**SRL-LO**), Singing High (**SRL-HI**), and Oscillator or Structural (**OSC**) Return Loss measurements on both 2-wire and 4-wire circuits. Once the **Return Loss** function key has been pressed, the 930A will send the selected return loss signal, and receive and display measurements.

Press softkey 2 to send the momentary default echo suppressor disable tone (**2100 Hz**) prior to testing. This tone is the CCITT phase reversal method. The first phase reversal occurs in the first 100 ms. Subsequent phase reversals occur every 450 ms. Hold down softkey 2 to send the tone continuously. Release softkey 2 to return the 930A to normal functionality. Use the numeric keypad to enter any other disable tone. The valid range is between 20 and 5000 Hz. The reading you get will not be valid unless echo suppressors/cancellers are disabled; these may be present on long distance circuits.

The 930A must be off-hook when measuring return loss.

TR TERM mode is available only if the 930A is in a 2-wire mode via the **Trunk Type** function key. Press softkey 1 under the measurement type to see:

Softkey 3 scrolls through the different type of terminations: **AC SHORT**, **AC OPEN**, 600 Ohm with 2.16 ufd (**600+2uf**), or 900 Ohm with 2.16 ufd (**900+2uf**).

3-3.1 Transhybrid Loss Measurements

The amount of loss across the Hybrid is used as a correction factor to the return loss measurement. The loss may be known from previous measurements (in which case it can simply be entered), or it may be measured by the 930A. In either case, the 930A will automatically correct its return loss readings accordingly.

To measure Transhybrid Loss, you must be able access the Hybrid because you will need to short out its 2-wire primary while you measure the 4-wire return loss at the secondary side. If you cannot access the Hybrid, leave the **THL** at the default of **0 dB**.

Press softkey 3, if required, to measure and enter the **THL** (transhybrid loss) correction. This correction is valid only in 4W.

3-3.1.1 Example: Measuring THL

Connect the 930A to the 4-wire side of the Hybrid and set the Trunk Type to the correct trunk for testing.

Short the 2-wire side of the Hybrid using a jumper cable.

Press the **Return Loss** function key on the 930A. Use **ERL** or **OSC** with a frequency of1004 Hz. This is mid-band for the measurement.

Press softkey 3 to measure the **THL**. The value will appear over softkey 3.

Press softkey 3 again and the 930A will prepare to set the measured value as the **THL** correction. Enter the desired number using the numeric keypad when the cursor is flashing over the measured value.

Press softkey 3 again and the measured value will be accepted. The far left of the display will read **MEAS THL**.

3-4 SEND TONE FUNCTION KEY

Press the **Send Tone** function key to send a tone. Use the numeric keypad to enter the desired frequency. The valid range in voice band is from **20 Hz** to **5000 Hz**. The valid range in Wideband is from **20 Hz** to **3 kHz**. Press the **ENT** key or any softkey to enter the frequency.

Press softkey 3 to enter level changes. The valid level range is from **+12.0 dBm** to **-60 dBm**. Use the numeric keypad and press **ENT**.

Softkey 4 toggles between tone **ON** and tone **OFF**. If the tone is **ON**, the display will read **TR** (Tip/Ring), **T1R1** (Tip1/Ring1), **PCM1** or **PCM2**, depending upon the Trunk Type and direction. If **OFF** is selected, no tone is sent and the 930A supplies quiet termination. THe 930A can send tone while simultaneously performing other functions. Whe a tone is being sent with the 930A peforming a different function, the LED beside the **Send Tone** function key will flash to alert you to the fact that tone is being sent. If no tone is desired, return to the **Send Tone** function and press softkey 4 to place the unit in quiet termination. The display will read **OFF** when in quiet termination. The tone selected in **Send Tone** is not sent in the **Dial/Ring** or **Return Loss** functions.

The hookswitch must be in the **Off Hook** position to send tones.

The Left/Right arrow keys position the cursor within a selected field, either frequency or level, from least significant to most significant digit.

The Up/Dn arrow keys increment or decrement the frequency or level depending upon the position of the cursor. The step size depends upon the position of the cursor within the field and may be either 1, 10, 100, or 1000 Hz in frequency or 0.1, 1, or 10 dB in level. Holding down the Up or Dn arrow keys will cause the 930A to sweep through the frequency or level steps. By selecting the appropriate frequency step size, you can generate a manual frequency sweep.

The 930A is capable of automatically sweeping tones over user-definable ranges. See **Section 6-10, Option Menu #: 10 Frequency Sweep** for more information.

3-5 MEASURE TONE FUNCTION KEY

To measure a received tone, press the **Measure Tone** function key.

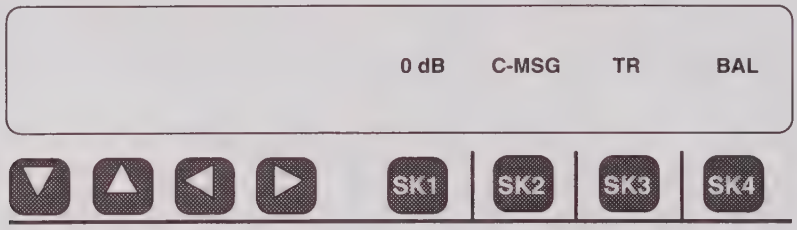
Softkey 2 enables you to select the 0 dB level relative to the current measurement. Initially the 930A displays the measurement in dBm and always returns to dBm when power is cycled. Press softkey 2 once to lock in the current measured value as the 0 dB reference point. Pressing softkey 2 again enables you to input a relative 0 numerically (numeric entry from the front panel keypad must be terminated by pressing **ENT** or any softkey). Press softkey 2 to return the 930A to **dBm** measurement. The 930A displays measurements in **dBm** (absolute relative to 1 milliwatt), **dB** (relative to a measured 0), or **dBm0** (relative to a specified 0 or transmission level point).

Softkey 3 toggles between the **AVERAGE** and **RMS** detectors. **AVERAGE** is typically used when measuring tone only. Use **RMS** when measuring tone with noise.

Softkey 4 is inactive. The display above it shows the input from which the measurements are being taken, for example, **TR** (Tip/Ring), **T1R1** (Tip1/Ring1), and optionally, **PCM1** or **PCM2**, depending on which Trunk Type has been chosen. Accurate measurements can only be made if the proper impedance has been selected in Trunk Type mode.

In Loop and Ground start modes, the position of the hookswitch can affect the AC Termination, and therefore, the measured level. Measurements in these Trunk Types should always be made with the 930A off-hook.

3-6 MEASURE NOISE FUNCTION KEY



To Measure Noise or Signal-to-Noise, press the **Measure Noise** function key.

Press softkey 1 to scroll through and select a relative **dB, dBrnC** or **dBrnC0** dB reference point, or to enter TLP correction factor. To enter a level in dBrnC0 mode, scroll through the reference points until a flashing cursor is displayed. Use the numeric keypad to enter the level. The valid parameters are between **+82** and **-116** dBrnC0.

Press softkey 2 to scroll through the weighting filters: **3K FLT** (3 kHz Flat), **C-MSG** (C-Message), **C-NOTCH**, or **S/N** (Signal-to-Noise). In Wideband, **15K FLT** (15 kHz Flat), **PROGRAM**, **50 K-BIT** and **E-FILTER** are also available filters.

Softkey 3 is inactive, displaying the input signal source (**TR, T1R1, PCM1,** or **PCM2**).

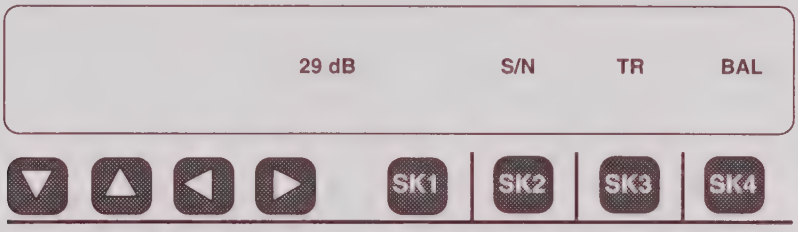
Softkey 4 toggles between **BAL** (balanced) or **N TO G** (Noise-to-Ground) measurements on analog trunks. Optionally, on PCM trunks, **CHANNEL** is displayed to indicate that the noise being measured is the noise on one channel and not the entire 24 channels. Softkey 4 is inactive on PCM trunks and also during Signal-to-Noise measurements.

Once you have set the correct Trunk Type, you can use **Dial/Ring** mode to call the far-end Type-100 test line. This will place a quiet termination on the line.

3-6.1 Example: Measuring Signal-to-Noise

After setting up the 930A to the correct Trunk Type, call the local milliwatt number to get a 1004 Hz tone sent back. Alternately, contact someone at the other end of the circuit and have them send 1004 Hz back. Press the **Measure Noise** function key.

To select the **S/N** ratio display, press softkey 2 until the display is:



The S/N ratio measurement requires that a holding tone be present at the measuring end of the circuit. On 2-wire trunks this usually means making an end-to-end measurement with one test set supplying 1004 Hz from one end and the other test set measuring the S/N at the other end. On a 4-wire trunk, the far-end can be looped back. In this case the 930A can generate a 1004 Hz tone at the appropriate level and then measure the S/N ratio coming back.

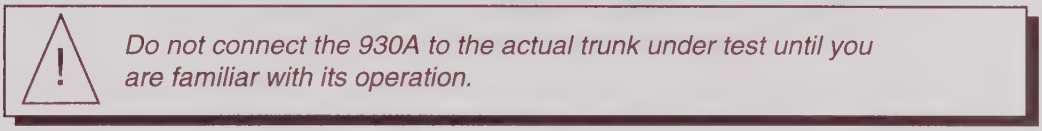
It is possible to set the relative zero for measurements in dB, using one weighting filter and then change to another filter. The display will then show the measurement in one filter relative to the other. This feature is particularly useful for measuring the notch depth of C-NOTCH filters.

4 ANALOG OPERATION

4-0 INTRODUCTION

This section of the manual provides you with information on the operation of the 930A's standard features. The 930A is a general purpose test set which has been designed to test Equal Access (Feature Group D), T1, PBX, Data, Toll, Message, and Private Line trunks. The 930A is particularly well-suited to testing at the DEMARC, or Point of Interface (POI).

The 930A retains the last settings you input. In most cases, it is only necessary to set up functions once.



Data entry on the 930A is accomplished in one of three ways: numeric entry using the numeric keypad; menu entry using the softkeys; or incremental entry using the cursor or arrow keys.

4-1 TRUNK TYPE FUNCTION KEY (ANALOG OPERATION)

For instructions on setting up a PCM Trunk Type, refer to **Section 5**.

When power is first applied to the 930A it will default to the last-used configuration under the **Trunk Type** function key. A typical display is shown below:

The following describes the standard Trunk Types that come with the 930A and their related softkey functionality:

Softkey 1	Softkey 2	Softkey 3	Softkey 4
NORMAL LOOP	BRIDGE/TERM	CONTACT/BATTERY	2W/4W 135-1200W
REVERSE LOOP	"	"	"
NORMAL GND-ST	"	"	"
REVERSE GND-ST	"	"	"
E&M I THRU V	"	SEND-E/SEND-M	"

Changing Trunk Types or changing from **2W** to **4W** operation automatically places the 930A in the **BRIDGE** mode. The 930A does not send supervision in this mode. The supervision lamp marked **Orig** shows the end of the circuit which the 930A would simulate if it were in **TERM** mode.

4-1.1 Example: E&M Trunk Type

Suppose that you need to test an E&M type trunk. The operation of the arrow keys and softkeys necessary to accomplish this is described in the following example.

For this example, we want to terminate a 4-wire E&M Type I trunk. Suppose that the Trunk Type function key has been pressed and we are starting from the **LOOP** start trunk displayed on the previous page.

Press either the Up/Dn arrow keys or softkey 1 and page through the various Trunk Types. Use the Up arrow key and scroll from **LOOP** to **E&M**.

When you get to the E&M trunks, the display below will appear:

To change the trunk and impedance, press softkey 4 to page through the various combinations.

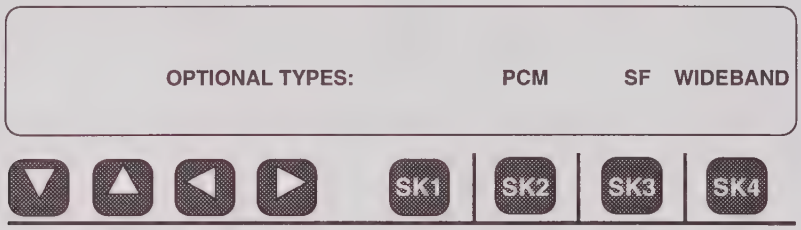
Determine whether to send supervision on the M-Lead or the E-lead. To simulate the originating end of the circuit, select **SEND-M**. To simulate the terminating end, select **SEND-E**.

To terminate the circuit, change from **BRIDGE** to **TERM** mode by pressing softkey 2. After completing these steps, the display will read:

The 930A is now ready to terminate a 4-wire E&M Type I trunk and send supervision on the E-Lead.

4-2 SF SUPERVISION OPERATION *(Purchased Option 930A-02)*

If your 930A is equipped with *Purchased Option 930A-02 SF SUPERVISION*, press the Trunk Type function key. Press softkey 1 or use the Up/Down arrow keys to scroll through the various Trunk Types until you see **OPTIONAL TYPES:**



The 930A presently does not support 2-wire SF Single Frequency systems which use 2 tones (2404 and 2604 Hz, for example), nor can it be used to provide SF Supervision on PCM systems.

Press softkey 3 under **SF** to enter the **SF SUPERVISION** Trunk Type. An example display is shown below:

Softkey 2 allows you to send on Tip/Ring (**SEND TR**) or Tip1/Ring1 (**SEND T1R1**).

Softkey 3 selects either **BRIDGE** or **TERM** operation.

Softkey 4 selects the impedance (**4W 150-1200** Ohm).

Place the front panel hookswitch in the **Off Hook** position.

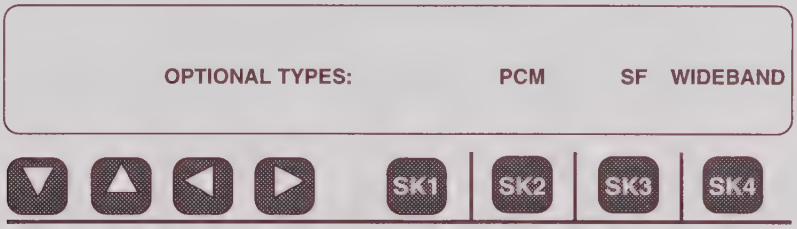
> *SF Supervision sends a 2604 Hz tone to indicate an on-hook condition. SF is inherently a 4-wire Trunk Type and is now mainly used on special service trunks in the U.S. It has been largely displaced in the network by CCIS and SS7 signaling types.*

4-3 WIDEBAND OPERATION *(Purchased Option 930A-40)*

The Wideband feature provides the capability to accomplish Wideband Transmission tests on metallic facilities in 2- or 4-wire configurations.

4-3.1 Set-up Procedure

Turn on the 930A. Press the **Trunk Type** function key. Scroll through the Trunk Type functions until you see **OPTIONAL TYPES**.



Press softkey 4 under **WIDEBAND**. The 930A will display the following screen below:

To test a 4-wire Wideband facility, scroll through the options displayed above to enable the Receive circuit. The following display will read:

Softkey 3 toggles **BRIDGE** to **TERM**:

Press softkey 2 until **TR 135** appears as shown below:

Press softkey 1 until **TERM** appears as shown below:

The Trunk Type selection is now complete. You can now continue to the connection of test cords and feature selection.

4-3.2 Return Loss in Wideband

The 930A is capable of ERL and SRL return loss only in the voice band Trunk Type configuration. Typically, this is not a test requirement for Wideband because of the Private Line nature of Wideband and no 2/4-wire Hybrids exist in this type of facility.

4-3.3 Send Tone in Wideband

Press the **Send Tone** function key. Notice the cursor over the last digit of the displayed frequency:

Press softkey 4 under **OFF** to turn on the transmitter. To change the frequency, press softkey 1. The valid parameters are between 20 Hz and 3 kHz. As an example, change the parameter to **20000 Hz** by using the numeric keypad.

The following display will result:

Press softkey 3 to change the level. As an example, change the parameter to **-16.0 dBm** by using the numeric keypad. The following will result:

You are now transmitting 20 kHz at a -16.0 dBm on the TR jack to the Transmit line facility.

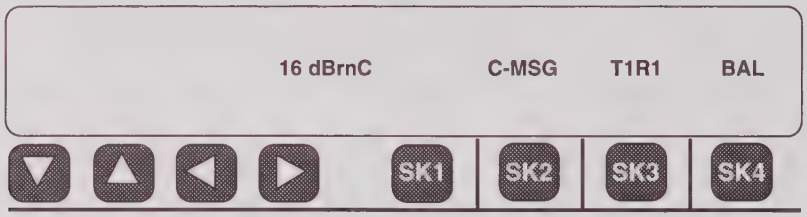
4-3.4 Measure Tone in Wideband

To measure and display the level and frequency of received tones, set up the 930A in the Wideband Trunk Type as described previously. Press the **Measure Tone** function key. The following display will result:

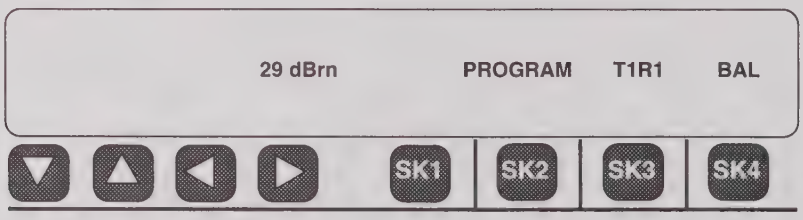
Press softkey 3 to toggle between **AVERAGE** and **RMS**.. These are the defaults for the **Measure Tone** function. The display above shows the input from which the measurements are being taken (**T1R1** in this example). **AVERAGE** is used when measureing tone only. Use **RMS** when measuring tone with noise.

4-3.5 Measure Noise in Wideband

To measure noise, set up the 930A in the Wideband Trunk Type as described previously. Press the **Measure Noise** function key. This causes the 930A to display the current measurements, filter weighting types, source, and balance.



The 930A measures noise using the **C-MSG** (C-Message), **C-NOTCH, S/N** (Signal-to Noise), **3K FLT, 15K FLT, E-FILTER** (50K Bessel), **PROGRAM**, and **50 K-BIT** filters in the Wideband Trunk Type. This can be done on 2-wire or 4-wire facilities. Press softkey 2 to scroll through the available filters. A typical measurement display is shown below:



This example shows a measurement of **PROGRAM** weighted noise in **dBrn** at the **T1R1** interface in balanced (**BAL**) mode.

The DSL and HDSL technologies will require a flat response out to approximately 100 kHz. The **E-FILTER** provides this capability.

Softkey 4 toggles between **BAL** and **N TO G** (noise-to-ground).

5 PCM OPERATION

5-0 INTRODUCTION

This section of the manual describes the operation of the 930A when *Purchased Option 930A-08E, Single Direction PCM)*or *Purchased Option 930A-09E, Dual Direction Drop & Insert* has been installed in the 930A.

> *If Purchased Option 930A-17, Remove Analog Interface has been ordered, PCM is the only available Trunk Type.*

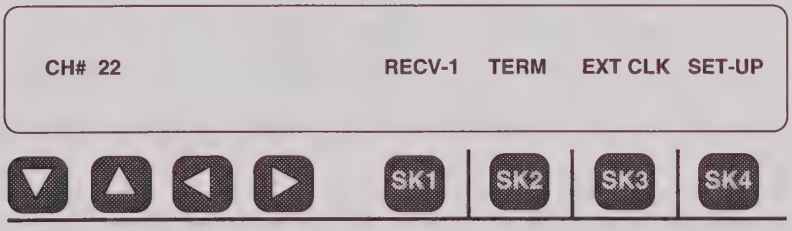
Purchased Options 930A-08E or *-09E* have the capability to operate on the normal D4 Superframe format T1 carrier, as well as the SLC-96 system and the Extended Superframe (ESF) format. The 930A will detect whether the T-Carrier is a D4 Superframe or ESF formatted signal, and set itself automatically when first plugged into the span at the DSX. The 930A does not set itself for SLC-96 framing; this option must be set manually to work on a SLC-96 span. See **Section 5-2, SLC-96 Set Up** and **Section 6-23, Option Menu Number 23** for more information. Once SLC-96 framing has been selected, the 930A operates exactly the same as it does on any other T1.

The factory DS-1 (T1) defaults are:

Impedance:	**100 OHMS**
Framing:	**D4 SUPERFRAME**
Signaling:	**ROBBED-BIT**
Line Coding:	**AMI** (ALTERNATE MARK INVERSION)
Channel Numbering Sequence:	**D3/D4**
Supervision:	**NORMAL** (E&M)

To select T1 (DS-1) PCM Trunk Type, press the **Trunk Type** function key. Press softkey 1 or the Up/Down arrow keys until you reach the following display:

Press softkey 2 under **PCM**. The display below shows the factory default **PCM** display:



5-1 CHANNELS AND TEST DIRECTION

> *Purchased Option 930A-08E, DS-1 PCM Single Direction* allows only **TERMINATE** and **MON-1** modes. To have the capability of looking in both directions, *Purchased Option 930A-09E, DS-1 PCM Dual Drop & Insert* must be installed. This option adds **MON-1&2** and **D&I** modes (two transmitters and two receivers).

To change the PCM channel, use the Up/Dn arrow keys, or enter the number of the channel (1 to 24) from the numeric keypad. The PCM channel number to be tested is displayed on the far left of the display. The factory default is **CH# 22**.

5-1.1 Test Mode

To select the span test mode, press softkey 2 under **TERM** to see:

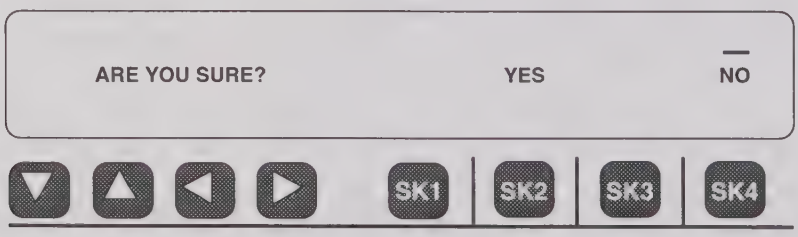
In **TERMINATE** mode, the 930A acts as a channel bank terminating one end of the span.

MON-1 is used for monitoring one direction of transmission.

MON-1&2 is used to monitor traffic in both directions simultaneously by activating both of the 930A's receivers.

D&I mode, or Drop & Insert, is used on live spans between two switches or multiplexers, etc. One of the 24 channels is dropped-out for testing while the other 23 pass through undisturbed.

If the 930A is in either **MON-1&2** or **D&I** mode and **TERMINATE** or **MON-1** mode is selected, the following screen will display:



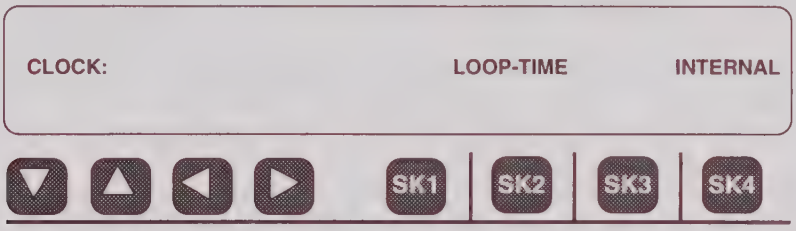
Press softkey 4 under **NO** to return to the current mode. Press softkey 2 under **YES** to activate **TERMINATE** or **MON-1**.

5-1.2 Test Direction

To select test direction, press softkey 1 under **RECV-1** from the main PCM display. This key is only active if the 930A is in the **MON-1&2** or **D&I** mode. It toggles between side 1 and side 2 without having to swap test cords around. If the 930A is in **TERMINATE** or **MON-1** mode, the key is inactive because only side 1 is receiving.

5-1.3 Clock

When the 930A is in **TERMINATE** mode, a clock source may be chosen. The 930A can be loop-timed (**LOOP-TIME**) to the span clock, or the 930A can supply the clock (**INTERNAL**). To select the clock source, press softkey 3 under **EXT CLK** in the main PCM display to see:



The cursor appears over the current selection. Internal clock is only available in the **TERMINATE** mode. The 930A will not insert its clock into a span in the **D&I** or **MON-1&2** modes.

In the **TERMINATE** mode, it is assumed that the T1 span you are terminating has been taken out of service for test purposes. With the other three modes it is assumed that live traffic may be on the span. Press softkey 2 or 4 for a clock source.

5-1.4 Set-up: Impedance

To change the default set-ups or the set-up you have previously entered, press softkey 4 under **SET-UP** from the main PCM menu. The first set-up menu is **IMPEDANCE**. The cursor appears above the current selection.

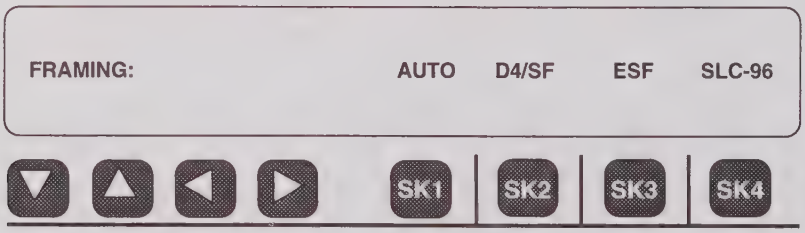
The following will display:

Use the **100 OHM** default at the DSX jacks (including the monitor jacks) or at the CSU or Office Repeater jacks. Use **>1K OHM** only in cases where your DSX does not supply isolation resistors.

> *If you leave the 930A in the **>1K OHM** position and connect it to the DSX monitor jacks (which already have 1000 Ohms of isolation), the signal will be distorted and cause error indications.*

Continue scrolling by pressing a softkey under a selection on the display or press the Up/Dn arrow keys. The 930A advances to:

5-1.5 Set-Up: Framing

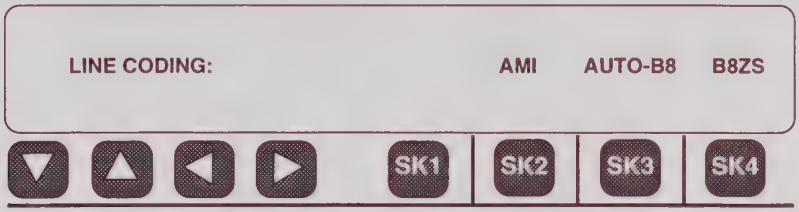


To change the framing format, you will need to know what kind of span you are on, unless you want the 930A to choose for you. In this case, leave **AUTO** selected. To not have the 930A choose for you, deselect **AUTO** by pressing softkey 1. For information on SLC-96 framing, see **Section 5-2**. Press the softkey under your choice. The display will advance.

5-1.6 Set-Up: Robbed Bit

ROBBED-BIT signaling is the most common form of T-Carrier signaling today. **CLEAR CHANNEL** operation is for those services that do not use in-channel signaling. Press softkey 2 or 4 accordingly. The display will advance:

5-1.7 Set-Up: Line Coding



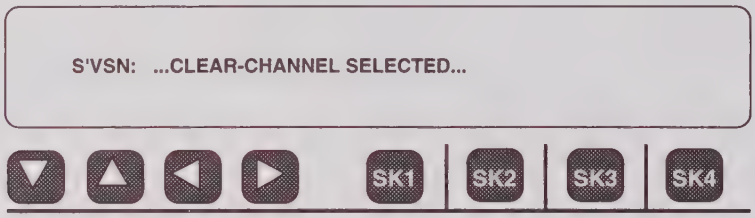
Select the proper line code for your T1 facility. Choose **AMI** (Alternate Mark Inversion) by pressing softkey 2. To include Auto B8ZS detection, select softkey 3 under **AUTO B8**.

> ***AUTO-B8*** *will allow automatic selection of B8ZS if that pattern is detected on the receive signal. This only occurs if* ***AMI*** *and* ***AUTO-B8*** *are selected.*

Press softkey 4 to send **B8ZS** immediately.

5-1.8 Set-Up: Channel Sequence

Select softkey 2, 3 or 4 as appropriate. If **CLEAR-CHANNEL** was selected (see **Section 5-1.6**), you will see the following display:



This message will remain on the screen until you press a softkey. You will return to the main PCM set-up screen.

If **ROBBED BIT** was selected (see **Section 5-1.6**), the 930A will advance.

5-1.9 Set-Up: Supervision

The default supervision is **NORMAL** and is equal to E&M signaling on digital switches. An on-hook is signalled by the A and B (or A, B, C and D) bits equalling a 0 state. An off-hook or busy is given by these bits equalling a 1 state.

Press softkey 1 under **DEFINED** to customize the 930A's on-hook/off-hook status. See **Section 5-7** for set-up information in **DEFINED** mode.

DEFINED *mode lets you define the on-and off-hook states to be any combination of A and B (or A, B, C and D) bits. If you change the* ***DEFINED*** *mode to other than A=B using DP (dial pulse), verify that the significant bit is also defined in Dial/Ring. See display below.*

Purchased Option 930A-25, FXO/FXS PCM Supervision allows the 930A to simulate the office-end or station-end of a Foreign Exchange circuit (**FXO** or **FXS**). See **Section 5-6** for set-up information in FXO or FXS.

When you have made the final selection, the 930A returns to the main **PCM** display.

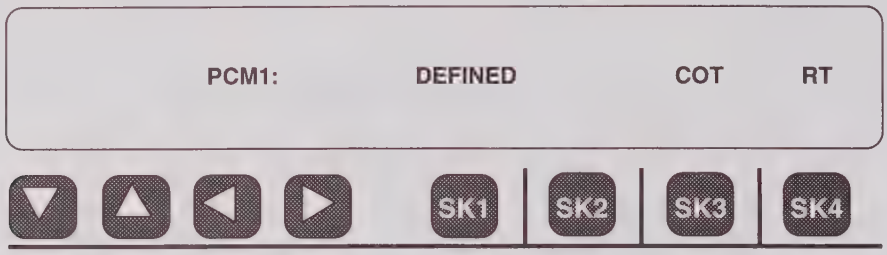
The 930A remembers all of its settings when you turn it off. It is not necessary to go to the **SET-UP** menus again unless you want to change something or unless you cold-boot the 930A, which restores the factory defaults.

The default for each PCM parameter is always chosen by pressing softkey 2 when you are in the ***SET-UP*** *menus.*

Select the proper supervision type for your T-Carrier span.

5-2 SLC-96 SET-UP

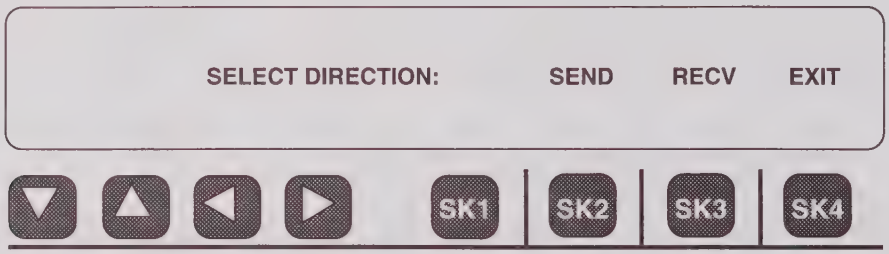
If you chose **SLC-96** framing, the next screen you see will be:



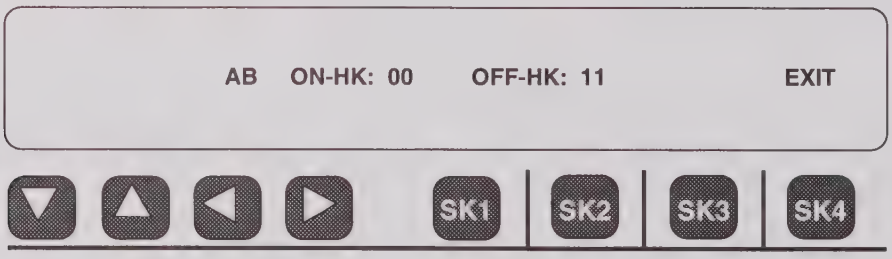
COT is the Central Office Terminal and **RT** is the Remote Terminal. Choose the appropriate softkey and you will be returned to the first PCM set-up menu.

5-2.1 SLC-96: Defined

Press softkey 1 or 2 under **DEFINED** to see:



To set-up the on-hook and off-hook states for AB bits, select softkey 2 or 3. An on-hook is signalled by the A and B (or A, B, C and D) bits equalling a 0 state. An off-hook or busy is given by these bits equalling a 1 state. *Purchased Option 930A-25* can simulate the office-end or station-end of a Foreign Exchange circuit (**FXO** or **FXS**). You will see the following screen:



After setting your parameters, press softkey 4 under **EXIT** to go back one menu and exit again to return to the main PCM set-up menu.

5-2.2 SLC-96: Central Office Terminal/Remote Terminal

Press softkey 3 under **COT** or softkey 4 under **RT** to see:

Press softkey 1 to select **SINGLE** party service. Press softkey 2 to select **COIN** service.

If **UVG** (universal voice grade) service is selected via softkey 3, the following screen is displayed:

Press softkey 1 or 2 for **GROUND-START**. Press softkey 3 or 4 for **LOOP-START**. You will be returned to the main PCM set-up screen.

Press softkey 4 under **MORE** from the first submenu to see:

Press softkey 1 to select **DID** (direct inward dial). Press softkey 2 to select FX (foreign exchange). Pressing softkey 4 toggles to the previous submenu.

For operation and further set-up instructions in SLC-96 mode, see **Section 6-23, Option Menu #: 23, SLC-96**.

5-3 HOW TO MONITOR A T1 SPAN

The test cord connection to the DSX monitor jack is shown in **Figure 5-1** below:

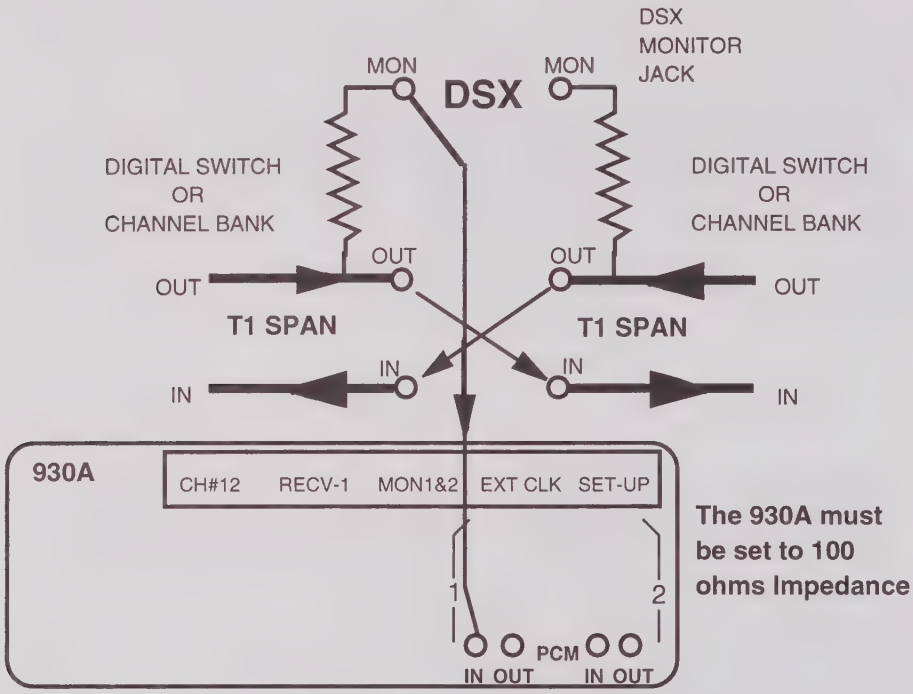


Figure 5-1
MONITORING ONE DIRECTION ON A T1

As shown in the diagram above, the test cord connection is from the 930A receiver (**PCM IN 1**) to the DSX monitor jack. The 930A display will look like the one below when it is set correctly.

With this set-up you may make measurements of anything such as level and frequency or noise. You may receive and analyze the digits of incoming calls if you have *Purchased Option 930A-01, MF/DTMF/DP Receiver and Analyzer*. You may move the test cord to the other monitor jack and capture the digits of the outgoing calls; measure the wink timing; listen to the traffic on the speaker; view the status of the A and B bits on all 24 channels; count BPVs, frame slips, frame errors, frame losses and CRC errors (ESF); or measure the T1 voltage at the DSX Monitor level. You may not do anything active like place a call or send a tone or measure return loss.

5-4 HOW TO MONITOR BOTH DIRECTIONS ON A T1 SPAN

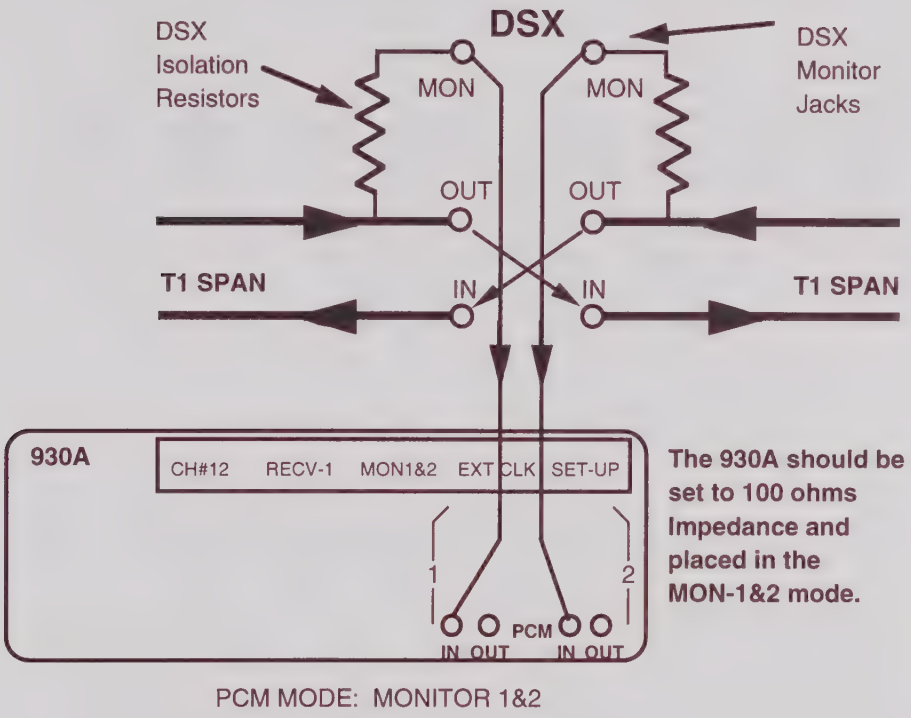
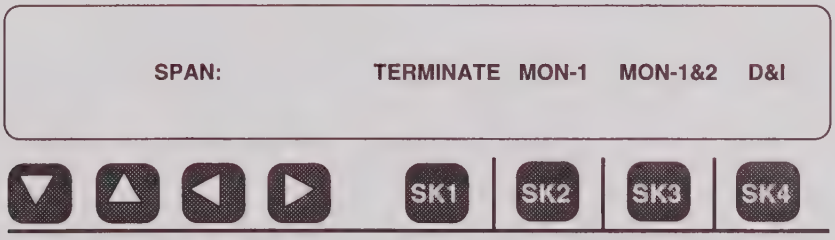


Figure 5-2
DUAL DIRECTION MONITORING

If your 930A is equipped with *Purchased Option 930A-09E, DS-1 PCM Dual Drop & Insert*, you can "look both ways" at the same time. From the diagram above, the test cord connections are from the 930A receivers (**PCM IN 1** and **PCM IN 2**) to the DSX Monitor jacks. The 930A has to be set to the **MON-1&2** mode. The process starts from the default **PCM** display.

Press softkey 2 under **TERM** to see:



To monitor both sides of the T1 span, press softkey 3 under **MON-1&2**. The main **PCM** display changes to:

Any channel from **1** to **24** is valid; channel 22 is the default. The 930A has the capability to perform all of the measurements mentioned under single direction monitoring on both sides at once. Press softkey 1 to toggle between **RECV-1** and **RECV-2**.

5-5 TERMINATING A T1 SPAN FOR OUT-OF-SERVICE TESTING

For testing trunks on out-of-service T1 span lines (pre-cutover or turned down for maintenance), the 930A can generate as well as receive a DS-1 signal. Once you have "Busied Out" the T1 span you are ready to connect the 930A toward the facility you want to test (switch, channel bank, etc.). The test cord connections at a standard DSX are shown below:

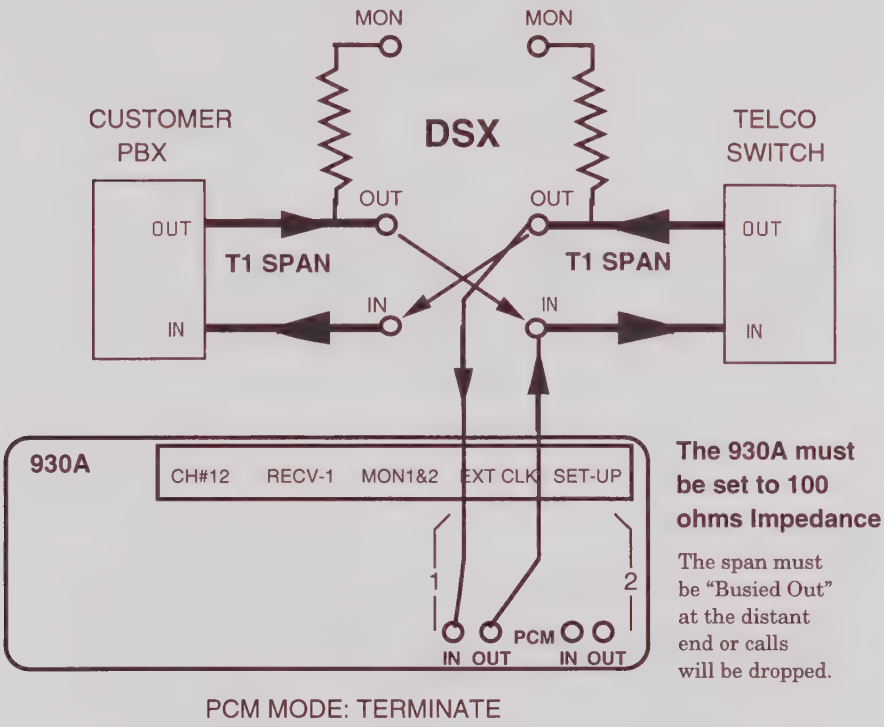
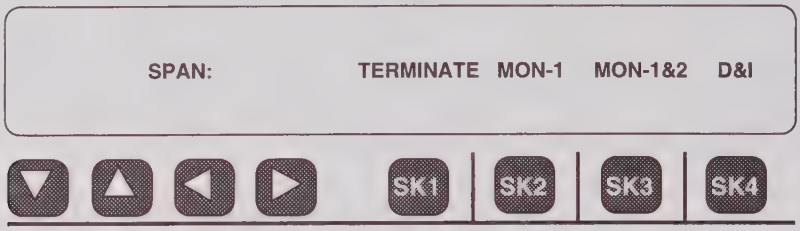


Figure 5-3
TERMINATING A T1 SPAN FOR OUT-OF-SERVICE TESTING

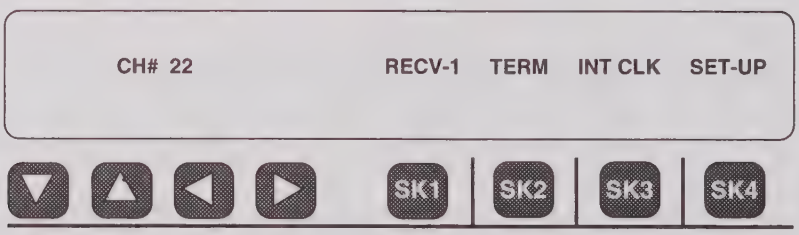


To Terminate the span, press softkey 1 to choose the **TERMINATE** mode. The 930A display shows:

When the 930A is in **TERMINATE** mode, a clock source may be chosen. The 930A can be loop-timed to the span clock, or you can have the 930A supply the clock.

To select a clock source, press softkey 3 under **EXT CLK** to see:

The cursor appears over the current selection.



Internal clock is only available in **TERMINATE** mode. The 930A will not insert its clock into a span in the **D&I** or **MON 1&2** modes.

Trunk transmission and signaling can be tested completely before the trunk is placed in service using the **TERMINATE** mode to simulate either end of a circuit. Place the 930A in **EXT CLK** mode to simulate the loop side of the circuit toward a switch. To test toward the loop (simulate the switch toward the customer), set the 930A to **INT CLK** mode and transfer the test cords to the DSX jacks looking out toward the Office Repeater or the customer's CSU.

5-6 DROP AND INSERT TESTING ON A T1 SPAN

The procedure for Drop & Insert testing is purposely a two stage process when using the 930A. Monitor both directions of transmission using the **MON-1&2** mode first, then try to solve your problems.

Begin by connecting the 930A to the DSX monitor jacks. The set-up diagram is shown in **Figure 5-4**.

The 930A display should look like the one below when you have correctly set up the main PCM display.

The valid channel numbers range between **1** and **24**. The above display shows **CH# 18** as an example only.

> *If the 930A reports PCM errors, verify and correct the connection problem before proceeding.*

The next step in the process is to leave the 930A set to **MON-1&2** and connect test cords from **PCM OUT 1** and **PCM OUT 2** to the input jacks on the DSX.

> ***Warning!*** *Connecting the test cords from the 930A's* ***PCM 1 OUT*** *and* ***PCM 2 OUT*** *jacks to the DSX's input jacks runs the risk of momentarily opening the span. You will need 100 Ohm termination plugs to plug into the output jacks of the DSX to keep the span from oscillating. If you do take a "hit" for any reason you will see a remote alarm indication on your 930A for a few seconds while the span reframes.*

The connection diagram is shown in ***Figure 5-4*** below:

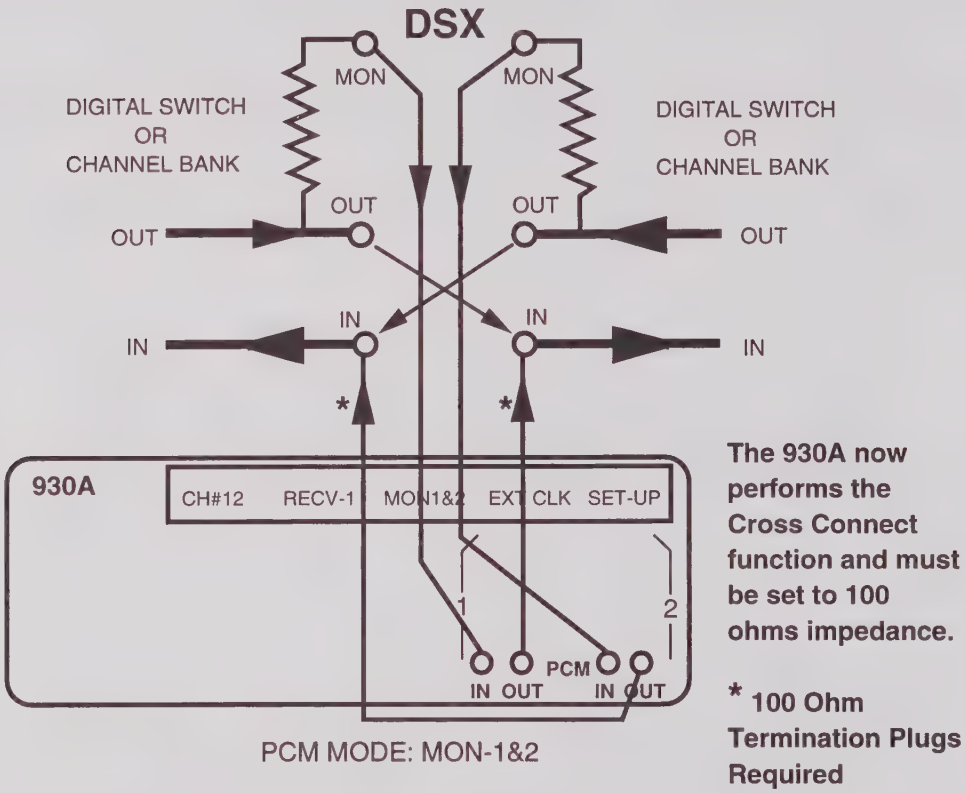
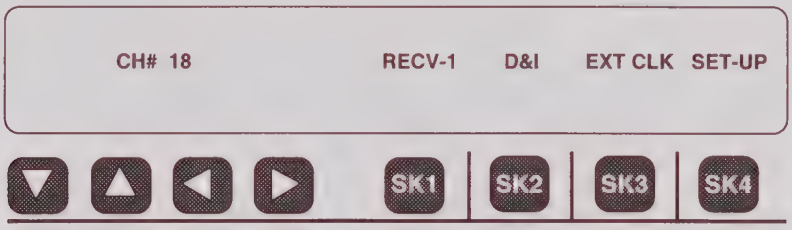


Figure 5-4
TEST CORD CONNECTIONS FOR DROP AND INSERT TESTING

Place 100 Ohm terminating plugs into the DSX output jacks as shown above to prevent the span from oscillating.

Press softkey 4 under **D&I** to drop the currently selected channel. The other 23 channels pass through undisturbed. Make sure the channel is idle before selecting **D&I**. You will see the following display.



This part of the process is "hitless," meaning once four test cords have been inserted, the danger of dropping the span is passed.

*If you are in **D&I** and change channels, the 930A will revert back to **MON-1&2**. This is a safeguard against inadvertently interfering with a working channel.*

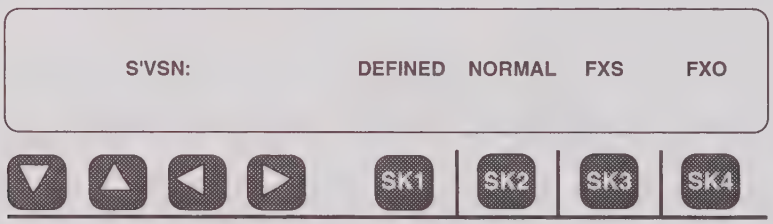
5-7 HOW TO DEFINE YOUR OWN ON/OFF-HOOK STATUS

The 930A will allow you the flexibility to define your own on- and off-hook states of the A/B/C/D bits. The **NORMAL** supervision default is the most useful, followed by **FXS/FXO** supervision. You can redefine what the 930A sends and recognizes as an on- or off-hook.

To redefine what the hookswitch sends instead of the default conditions, start at the main **PCM** display. An example follows:

Press softkey 4 under **SET-UP** and the first set-up menu you see is:

To get to the supervision set-up, press the Up arrow key to scroll through the set-ups to the following:



To define your own states, press softkey 1 under **DEFINED**. Your will see the following screen:

After selecting the proper direction and depending on whether D4 Superframe or ESF is selected, one of the following displays will appear:

D4/SF

ESF

Note the cursor over the A bit position of the **ON-HK** state. Change the state of the **ON-HK A,B,C** or **D** bits by moving the cursor with the Left/Right arrow keys and then enter a **1** or a **0** from the keypad. You can also change states using the Up/Dn arrow keys. Change the **OFF-HK** states by pressing softkey 3; the cursor will move to the **OFF-HK** side.

5-7.1 Example: On/Off-Hook

If the 930A is on a D4 Superframe span and you want an **ON-HK** to be 01 instead of 00, and an **OFF-HK** to be 10 instead of 11, move the cursor over the B bit position and enter a **1** from the keypad:

Press softkey 3. Use the Right arrow key to move the cursor over the **OFF-HK** B bit and enter a **0** from the numeric keypad.

The display would look like:

Return to the main menu by pressing softkey 4 under **EXIT** twice. (Selecting **EXIT** once will return you to the **DIRECTION** screen.) When you go off-hook using the front panel hookswitch, the 930A will send 10 instead of 11. Likewise, the on-hook will be 01 instead of 00.

When the 930A detects the off-hook bit pattern, the **OFF HOOK** LED on the front panel lights. When the on-hook bit pattern is detected, the **ON HOOK** LED lights. If neither bit pattern is detected, the LEDs do not light. If the supervision LEDs on your front panel are not lit, the supervision bit patterns are not correctly defined.

Remember to reset the 930A back to **NORMAL** when you are finished testing in the **DEFINED** mode. You will have problems drawing dial tone and getting the supervision LEDs to read properly on a regular PCM channel if you do not.

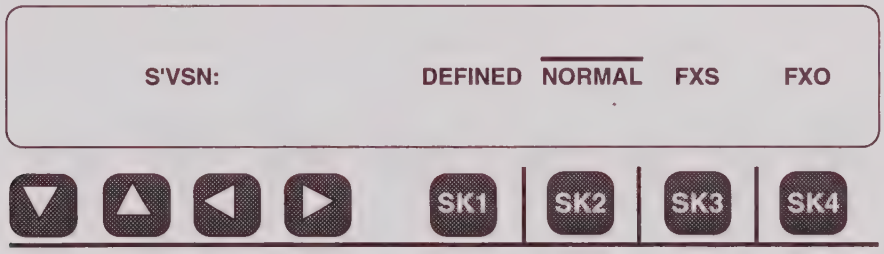
5-8 HOW TO SELECT FOREIGN EXCHANGE SUPERVISION

Your 930A must be equipped with *Purchased Option 930A-25, DS-1 PCM FXO/FXS Supervision* to operate on Foreign Exchange circuits on PCM Trunks. The option appears under the **PCM SET-UP** menu for supervision:

An example of the display for the **D&I** mode follows. Below is the main PCM display:

Press softkey 4 under **SET-UP** to get into the set-up menus, starting at **IMPEDANCE**.

Use the Up arrow key to scroll to the **S'VSN** display:



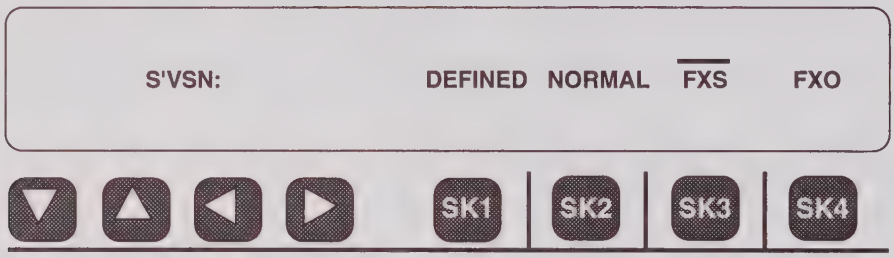
A brief description of the Foreign Exchange Station (FXS) and the Foreign Exchange Office (FXO) when in D4 Superframe mode follows to assist you.

5-8.1 FXS Description

In Foreign Exchange Station (**FXS**) mode, when the 930A is on-hook, it sends the Loop Idle bit pattern (A=0, B=1). When the 930A is off-hook, it sends the Ground-on-Ring bit pattern (A=0, B=0) until the far-end Foreign Exchange Office (FXO) returns Ground-on-Tip (A=0). The 930A will then send the Loop Closed bit pattern (A=1, B=1). This mode works equally with Loop Start and Ground Start offices.

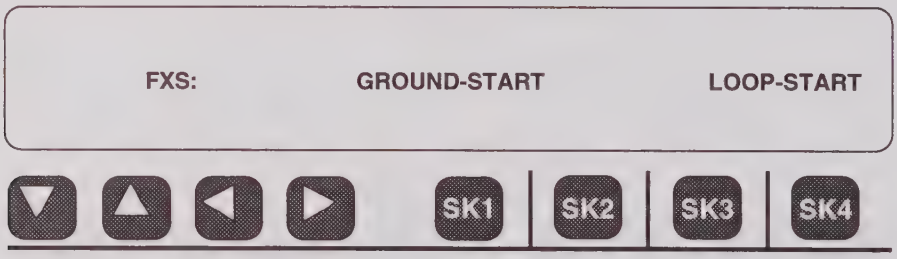
The 930A assumes that the far-end is sending **FXO** supervision and interprets A=0 to mean Tip Ground (off-hook), and A=1 to mean No Tip Ground (on-hook). B=0 is interpreted as Ringing. B=1 is interpreted as No Ringing.

5-8.2 FXS Set-up



Press softkey 3 under **FXS** to select **FXS** (PBX or Station-end) supervision.

The next screen will show:



Press softkey 1 or 2 for **GROUND-START**.

Press softkey 3 or 4 for **LOOP-START**.

You will return to the main PCM display. The front panel hookswitch will now follow the type of Foreign Exchange supervision you selected. Remember to reset your supervision to **NORMAL** when you are finished testing in FXS/FXO so that you can operate on regular PCM channels.

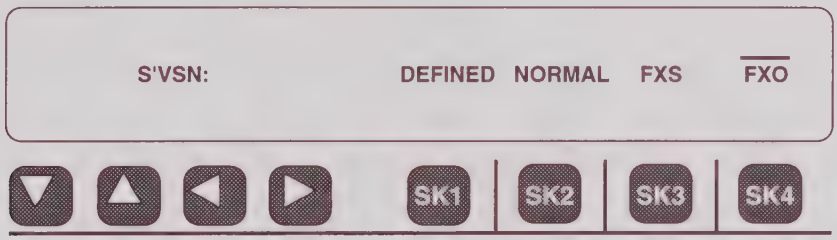
5-8.3 FXO Description

In Foreign Exchange Office (**FXO**) mode, when the 930A is on-hook, it will send the No Ground-on-Tip bit pattern (A=1, B=1). When the 930A is off-hook it will send the Ground-on-Tip bit pattern (A=0, B=1).

The 930A leaves the B bit set (B=1) to indicate No Ringing. You can send Ringing to the far-end by entering **OPTION MENU #: 21 TOGGLE A\B BITS** and setting the B bit to 0 manually. The B bit will revert to a 1 when the user exits the **TOGGLE A\B BITS** menu option.

The 930A assumes that the far-end is sending **FXS** supervision and interprets either Ring Ground (A=0, B=0) or Loop Closed (A=1, B=1) as an off-hook. This enables the 930A to operate with either Loop Start or Ground Start FXS equipment. The 930A interprets Loop Idle (A=0, B=1) as an on-hook. The unused bit pattern (A=1, B=0) is also interpreted as an on-hook.

5-8.4 FXO Set-up



Press softkey 4 under **FXO** to select **FXO** (or Central Office-end) supervision.

The next screen will show:

Press softkey 1 or 2 for **GROUND-START**.

Press softkey 3 or 4 for **LOOP-START**.

You will return to the main PCM display. The front panel hookswitch will now follow the type of Foreign Exchange supervision you selected. Remember to reset your supervision to **NORMAL** when you are finished testing in FXS/FXO so that you can operate on regular PCM channels.

5-9 DROP AND INSERT TEST CORD CONNECTIONS AT A T1 CSU

The block diagram of a typical T1 Customer Service Unit (CSU) is shown in ***Figure 5-5*** below. From this diagram, you can see that the test access jacks for monitoring are not wired the same as those in a DSX jack field. For this reason it is not possible to use these jacks when connecting the 930A for Drop & Insert testing at a CSU.

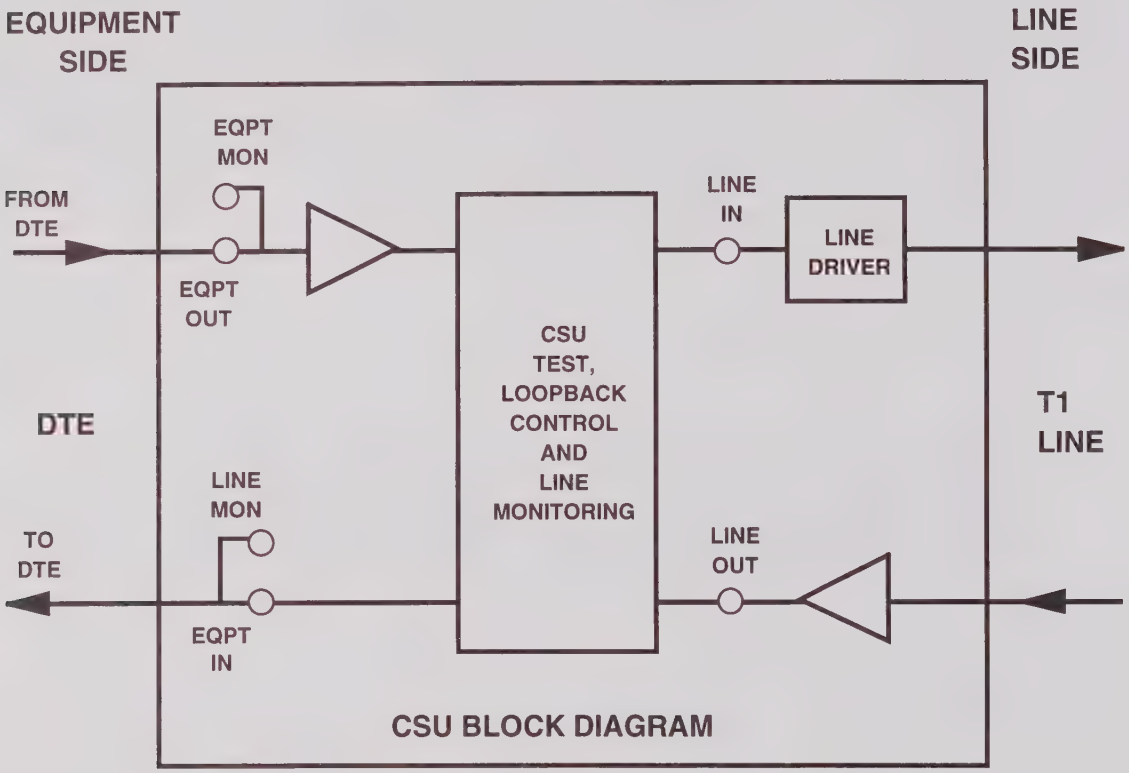


Figure 5-5
CUSTOMER SERVICE UNIT

In order to perform a D&I at the CSU, the 930A must pass the traffic from Equipment Out to Line In and from Line Out to Equipment In. This procedure should be done out-of-hours or after the users have been alerted. The same warning applies when removing the test cords.

The following diagrams describe the recommended procedure for connecting test cords between the 930A and a T1 CSU to do a D&I test.

The first step is to place the 930A in the **MON-1&2** mode with its settings at **100 OHM** impedance, **D4/SF** (or Extended Superframe as appropriate), **ROBBED-BIT** signaling, **AMI** line code, **D3/D4** channel sequence and **NORMAL** supervision. These are the most common settings. They can always be changed later.

Plug test cords into the two inputs of the 930A and then plug the other ends of these test cords into the **LINE OUT** and **EQPT OUT** jacks on the CSU as shown below:

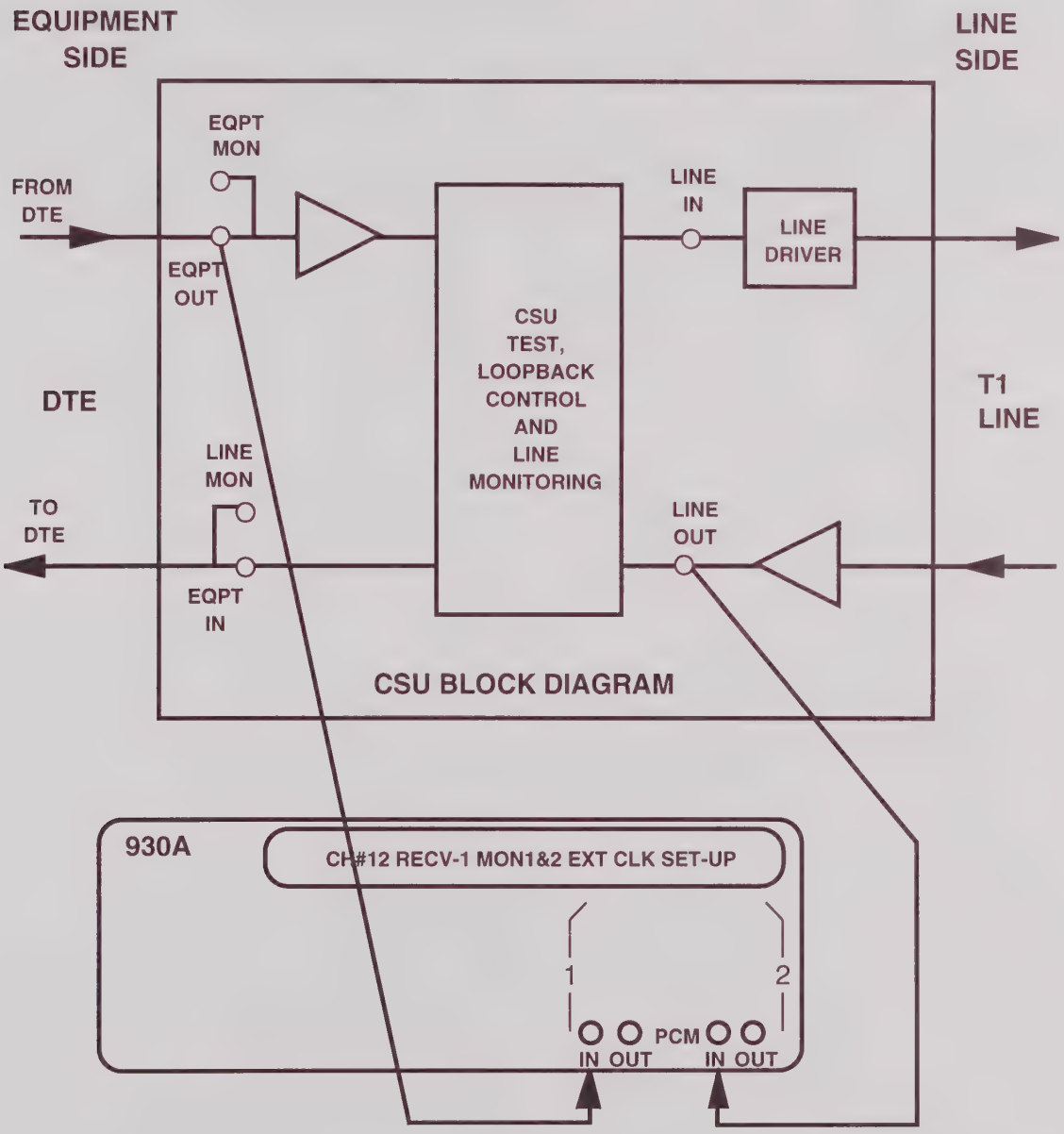


Figure 5-6
TEST CORD CONNECTION AT T1 CSU

Connect test cords from the 930A outputs to the **CSU LINE IN** and **EQPT IN** jacks as shown below:

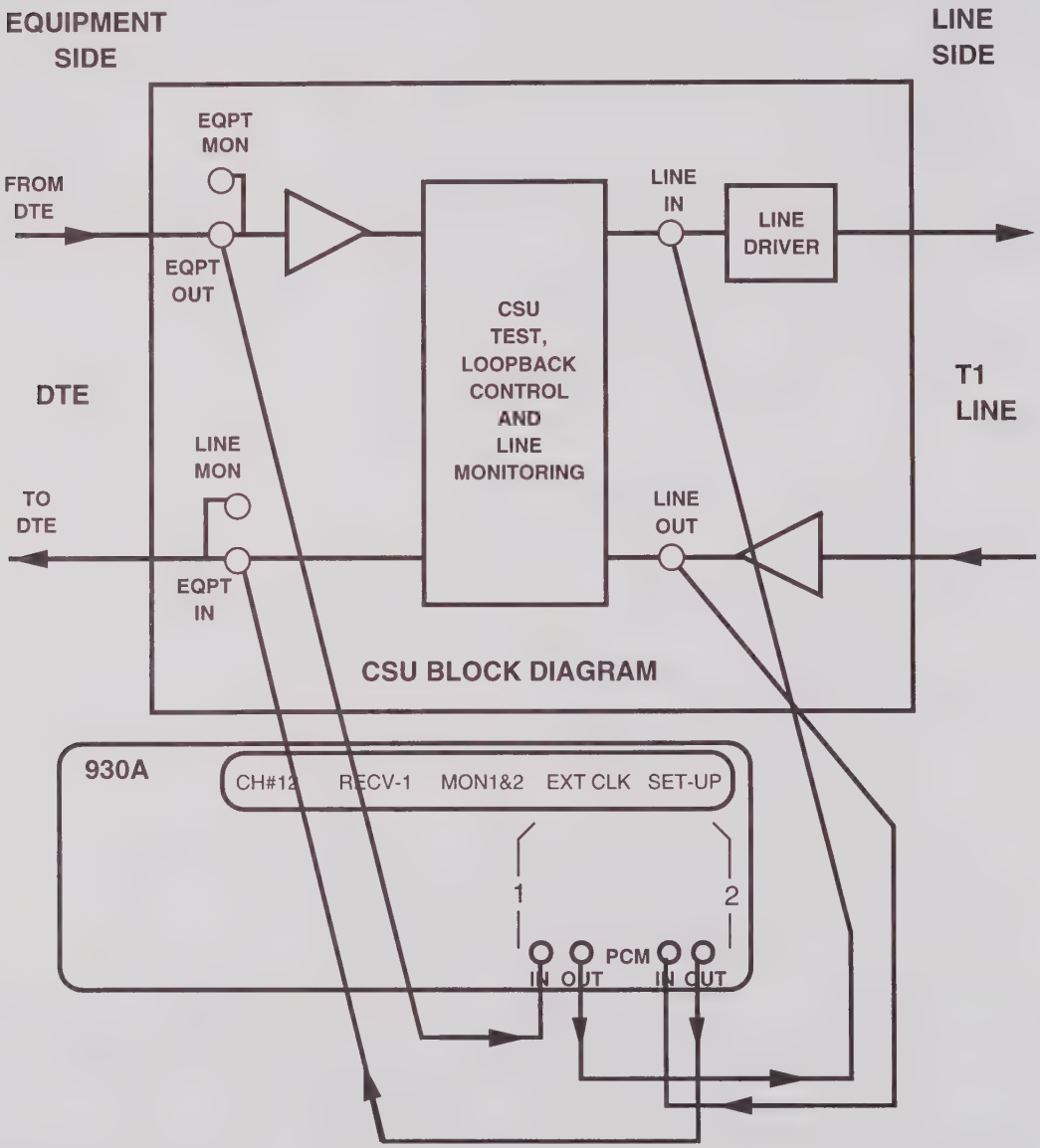


Figure 5-7
CSU LINE AND EQPT JACKS

After a few seconds the remote alarm indication will clear and the 930A will frame up to the signal. If an ESF line is in use, the 930A will automatically frame up to it.

Once you have successfully framed up to the T1 signal, the last step is to place the 930A in the **D&I** mode.

Press the softkey under **MON 1&2** to bring up the selections **MON-1, MON1&2, D&I**. Press the softkey under **D&I** to select that mode.

At this point you can perform any testing on a Drop & Insert basis that the 930A is capable of. This includes sending or receiving calls, transmission measurements, supervision monitoring and DS-0 Bit Error Testing.

6 OPTION MENU NUMBERS

6-0 OPTION MENU NUMBERS AND PURCHASED OPTION NUMBERS

The following chart illustrates the 930A's internal options. In addition, 930A *Purchased Options* are listed with their corresponding internal Option Menu Numbers.

Purchased Options Numbers and Internal Option Menu Numbers do not correspond. For example, (internal) Option Menu # 11 is effective when Purchased Option 930A-07 is installed.

Option Menu # (Internal)	Description	Purchased Option Number
1	MODIFY DIAL/RING	STANDARD
2	SEND DIGIT SEQUENCES	STANDARD
3	REMOTE CONTROL	PURCHASED OPTION 930A-10C
4	DIGIT RECEIVER	PURCHASED OPTION 930A-01
5	RING LOAD	PURCHASED OPTION 930A-13
6	DC VOLT/AMP METER	STANDARD
7	SUPERVISION THRESHOLDS	STANDARD
8	SUPERVISION MONITOR	STANDARD
9	WINK TIMING	STANDARD
10	FREQUENCY SWEEP	STANDARD
11	IMPULSE NOISE & HITS	PURCHASED OPTION 930A-07
12	WINK MARGINING	PURCHASED OPTION 930A-01
13	PHASE/AMPLITUDE JITTER	PURCHASED OPTION 930A-18
14	SET TIME AND DATE	PURCHASED OPTION 930A-10C
15	BEEP ON ERR?	STANDARD
16	DIGIT RECEIVER TIMEOUT	PURCHASED OPTION 930A-01
17	ENVELOPE DELAY DISTORTION	PURCHASED OPTION 930A-19
18	P/AR RATIO	PURCHASED OPTION 930A-06
19	4-TONE INTERMODULATION	PURCHASED OPTION 930A-20
20	24 BIT DISPLAY	PURCHASED OPTION 930A-8E, 9E
21	TOGGLE A/B BITS	PURCHASED OPTION 930A-8E, 9E
22	ABSOLUTE DELAY	PURCHASED OPTION 930A-21
23	SLC-96 CONTROL BITS	STANDARD
24	POST TPT DELAY	PURCHASED OPTION 930A-12
25	FAR END RESPONDER	PURCHASED OPTION 930A-12
26	ROTL/RESPONDER	PURCHASED OPTION 930A-12
27	ROTL INTERROGATOR	PURCHASED OPTION 930A-12
28	NOT INSTALLED	
29	CALL 102 LINE	PURCHASED OPTION 930A-29
30	ADJUST TLP	STANDARD
31	SEND HOOK FLASH	STANDARD
32	DIAL-UP TESTLINE	STANDARD
33	DIAL-UP SWEEP	STANDARD
34	SELECT REPORTS	PURCHASED OPTION 930A-10
35	DUAL TONE SENDER	STANDARD
36	NOT INSTALLED	
37	LINE STATUS	PURCHASED OPTION 930A10C
38	NOT INSTALLED	
39	REMOTE AUDIO	PURCHASED OPTION 930A-47
40	SEND PCM ALARMS	PURCHASED OPTION 930A-8E, 9E
41	READ T1 VOLTAGE	PURCHASED OPTION 930A-8E, 9E
42	T1 WANDER	PURCHASED OPTION 930A-8E, 9E
43	T1 ERROR COUNTERS	PURCHASED OPTION 930A-8E, 9E

44	T1 ERROR HISTORY	PURCHASED OPTION 930A-9E
45	T1 ERROR INJECT	PURCHASED OPTION 930A-9E
46	DS-1 BIT ERROR RATE	PURCHASED OPTION 930A-22
47	APS TEST	PURCHASED OPTION 930A-22
48	CSU EMULATION	PURCHASED OPTION 930A-44
49	NOT INSTALLED	
50	BATCH MODE	PURCHASED OPTION 930A-29
51	TEST RESULTS	PURCHASED OPTION 930A-29
52	NOT INSTALLED	
53	NOT INSTALLED	
54	DCS INTERFACE	PURCHASED OPTION 930A-45
55	NOT INSTALLED	
56	DS-0 BIT ERROR RATE	PURCHASED OPTION 930A-22
57	DS-0 LOOPBACK	PURCHASED OPTION 930A-22
58	DDS BIT ERROR RATE	PURCHASED OPTION 930A-24, 34
59	NOT INSTALLED	
60	NOT INSTALLED	
61	NOT INSTALLED	
62	NOT INSTALLED	
63	NOT INSTALLED	
64	NOT INSTALLED	
65	GND-ST COIN PHONE	STANDARD
66	NOT INSTALLED	
67	NOT INSTALLED	
68	NOT INSTALLED	
69	NOT INSTALLED	
70	NOT INSTALLED	
71	NOT INSTALLED	
72	NOT INSTALLED	
73	NOT INSTALLED	
74	NOT INSTALLED	
75	REMOTE UPGRADE	STANDARD
76	NOT INSTALLED	
77	NOT INSTALLED	
78	NOT INSTALLED	
79	NOT INSTALLED	
80	KEYBOARD LOCKOUT	STANDARD
81	NOT INSTALLED	
82	NOT INSTALLED	
83	NOT INSTALLED	
84	NOT INSTALLED	
85	NOT INSTALLED	
86	NOT INSTALLED	
87	TPT BURST LENGTH	PURCHASED OPTION 930A-12
88	NOT INSTALLED	
89	PRINTER HAND SHAKE	PURCHASED OPTION 930A-10
90	DSP MEMORY TEST	PURCHASED OPTION 930A-01
91	SOFTWARE VERSION	STANDARD
92	SOFTWARE COLD-BOOT	STANDARD
93	TEST DISPLAY	STANDARD
94	LIST OPTIONS	STANDARD
95	DRY CIRCUIT	STANDARD
96	TEST EXTENDED RAM	PURCHASED OPTION 930A-32
97	HOLD CONTROL	STANDARD
98	ESF BOARD SOFTWARE VERSION	PURCHASED OPTION 930A-8E, 9E
99	NOT INSTALLED	

Option Menu Numbers listed as NOT INSTALLED are reserved for future expansion.

6-0.1 Option Menu Function Key

There are two ways to access the Option Menu numbers.

1. Select the desired Option Menu number using the numeric keypad and press **ENT**. The first set-up screen will be displayed.

2. Use the Up/Down Arrow keys to scroll up to **OPTION MENU #:99** or down to **OPTION MENU #:1**; the arrows keys do not "wrap" from 99 to 1. The name of the option displays with the number, for example, **OPTION MENU #:11 IMPULSE NOISE & HITS**. Press the **ENT** key or any softkey to enter the option. The first set-up screen will be displayed.

Exit the Option Menu numbers by pressing the **Option Menu** function key or any of the other 6 function keys. In many cases, one of the softkeys inside the option will be labeled **EXIT**; pressing this softkey will also exit the option.

> *The **Option Menu** numbers should not be confused with the Purchased option numbers. For example, Internal **OPTION MENU #:11 IMPULSE NOISE & HITS** is effective with Purchased Option 930A-07, Impulse Noise & Hits.*

6-1 OPTION MENU #: 1 MODIFY DIAL/RING

Before entering **OPTION MENU #1**, select the type of digits to be sent (MF, DP, DTMF or RING) from the **Dial/Ring** function. See **Section 3, Function Key Operation** for details on the **Dial/Ring** function key.

After completing the initial set-up as described above, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **1** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

There will be one of three possible displays shown depending upon your selection from the **Dial/Ring** function key. The display for **MF** or **DTMF** are identical; the displays for **DP** and **RING** are different. The following sections will describe how to modify the different types.

If **DP** is selected from the **Dial/Ring** function key, see **Section 6-1.2**.

If **RING** is selected from the **Dial/Ring** function key, see **Section 6-1.3**.

6-1.1 MF or DTMF Digits

If **MF** or **DTMF** mode was selected under the **Dial/Ring** function key, the following display is:

6-1.1.1 Level

To change the output level of the digits, press softkey 1 under **LEVEL** to see:

Press softkey 1 to modify the low frequency tone level. The valid range is from **-99.9** to **+12.0**. Use the numeric keypad to change the value. Use the **D** key on the numeric keypad to change from – to +. Enter the valid parameter by pressing **ENT** or any softkey.

Press softkey 2 to modify the high frequency tone level. The valid range is from **-99.9** to **+12.0**. Use the numeric keypad to change the value. Use the **D** key on the numeric keypad to change from – to +. Enter the valid parameter by pressing **ENT** or any softkey.

If the value has not yet been entered (the cursor is flashing over the value), pressing softkey 3 under **DEFAULT** will enter the value currently displayed (as will pressing any other softkey once). Selecting **DEFAULT** again will change the displayed value to the default value.

Press softkey 4 to return to the **MODIFY** screen.

6-1.1.2 Frequency

To change the frequencies of the digits being sent, press softkey 2 under **FREQ** from the **MODIFY** screen to see:

Press softkey 1 to modify the low tone percentage. Press softkey 2 to modify the high tone percentage. The valid range is from **-99.9** to **+99.0**. Use the numeric keypad to change the value. Use the **D** key on the numeric keypad to change from – to +. Enter the valid parameter by pressing **ENT** or any softkey.

Pressing softkey 3 under **DEFAULT** will enter the value currently displayed (as will pressing any other softkey once). Selecting **DEFAULT** again will change the displayed value to the default value. The default values vary depending on if you are in MF or DTMF, or in an analog or PCM Trunk Type.

Press softkey 4 to return to the **MODIFY** screen.

6-1.1.3 Timing

To change the timing of the digits to be outpulsed, press softkey 3 under **TIMING** from the **MODIFY** screen to see:

To modify the **ON** or **OFF** values, press the appropriate softkey and enter the desired time from the keypad. The valid range is from **10 ms** to **9999 ms**. Press any softkey or **ENT** to enter the value.

Softkey 3 enters the **DEFAULT** values. If in MF, the default is **70 ON 70 OFF**. If in DTMF, the default is **50 ON 50 OFF**. If using a KP, add 30 ms to the **ON** time.

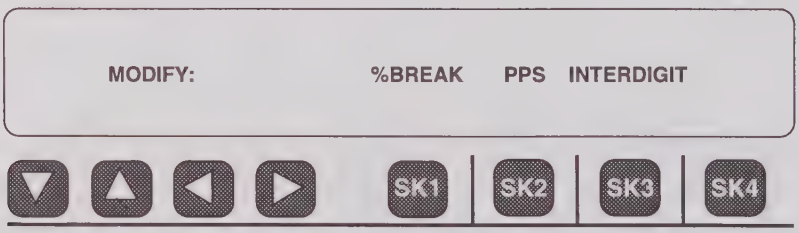
Softkey 4 will return you to the main display.

Press the Option Menu function key to exit this option.

Using the **Dial/Ring** function key, any sequence of digits which is outpulsed will be sent with the modifications set in **OPTION MENU #: 1 MODIFY DIAL/RING**.

6-1.2 DP Digits

If **DP** mode was selected under the **Dial/Ring** function key, you will see the following display:



6-1.2.1 % Break

To change the **% BREAK**, press softkey 1. You will see the following display:

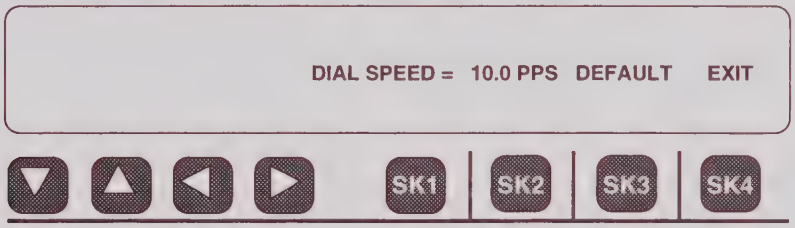
The valid range is from **25.0%** to **80.0%** with a default percentage of **60.0%**. Enter the percentage from the numeric keypad. Press any softkey or **ENT.**

Press softkey 3 to reset the value to the default.

Press softkey 4 to exit back to the main menu display.

6-1.2.2 Pulse Per Second

To change the **DIAL SPEED**, press softkey 2 under **PPS**. You will see the following display:



The valid range is from **2.0 PPS** to **35.0 PPS** with a default value of **10.0 PPS**. Enter the valid dial speed using the numeric keypad. Press any softkey or **ENT.**

Press softkey 3 to reset the value to the default.

Press softkey 4 to exit back to the main menu.

6-1.2.3 Interdigit Time

To change the **INTERDIGIT TIME**, press softkey 3 under **INTERDIGIT**:

The valid range is from **100 ms** to **990 ms** with a default value of **700 ms**. Change the **INTERDIGIT TIME** using the keypad. Press any softkey or **ENT**.

Press softkey 3 to reset the value to the default.

Press softkey 4 to exit back to the main menu.

6-1.3 Ring Generator

For the ring generator (**RING**) to be valid, *Purchased Option 930A-13, REN-3 LOAD* must be installed and the 930A must be supplying **BATTERY** in an analog Trunk Type, in **TERMINATE** mode.

If you selected **BATTERY** under the **Trunk Type** function key and **RING** under the **Dial/Ring** function key, you will see:

6-1.3.1 Level

If you do not have a ring load connection to either the T1R1 or TR jacks on the front panel of the 930A, pressing softkey 1 under **LEVEL** will show:

Press softkey 4 to exit and make all proper connections.

If a ring load is connected, pressing Softkey 1 under **LEVEL** will bring up the following display:

The valid range is from **15 VRMS** to **99 VRMS** with a default of **86 VRMS**. To change the voltage, enter the new value using the keypad. Press any softkey or **ENT**.

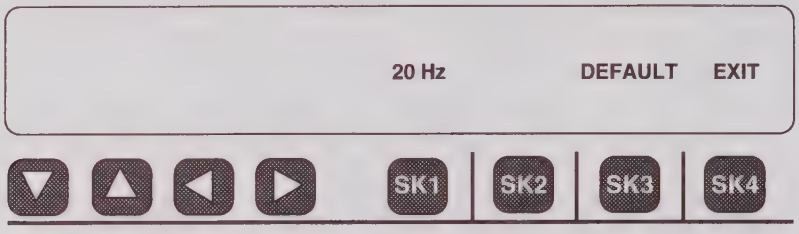
Press softkey 3 to reset the value to the default.

Measurements higher than 86 VRMS may be distorted.

Press softkey 4 to exit back to the main menu.

6-1.3.2 Frequency

To change frequency, press softkey 2 under **FREQ**. The following will be displayed:



The valid range is from **15 Hz** to **65 Hz** with a default of **20 Hz**. To change the frequency, enter the new value using the keypad. Press any softkey or **ENT**.

Press softkey 3 to reset the value to the default.

Press softkey 4 to exit back to the main menu.

6-1.3.3 Timing

To change the On/Off ringer interval, press softkey 3 under **TIMING**. The following will be displayed:

To change the ring interval, press softkey 1 for **ON** time and softkey 2 for **OFF** time. Enter the new value using the keypad. The valid range is from **150** milliseconds to **9999** milliseconds, with a default of **2000** milliseconds for **ON** and **4000** milliseconds for **OFF**. Press any softkey or **ENT**.

Press softkey 3 to reset the default values.

Select softkey 4 under **EXIT** when complete.

6-2 OPTION MENU #: 2 SEND DIGIT SEQUENCES

OPTION MENU #: 2 SEND DIGIT SEQUENCES allows you to send more than one phone number in sequence (Feature Group D, TSPS, etc.), or send a very long string of digits (up to 72 digits), or continuously send a sequence of digits over and over. This Option Menu Number operates in conjunction with the **Dial/Ring** function key and the **STO** (store) function.

The procedure starts with entering the telephone numbers you want to send one at a time in the under **Dial/Ring** function key. Store each of these strings (for example **4087611000**, **5551212**, etc.,) one at a time in any of the **998** registers (**01** to **998**). You then select **OPTION MENU #: 2 SEND DIGIT SEQUENCES**, enter the menu, and input the storage location numbers instead of the phone numbers.

The following examples will show you how to send a multi-wink sequence such as a Feature Group D, how to send a wink start sequence, and how to send up to a 72-digit long string.

6-2.1 Example: How to Build a Feature Group D Sequence

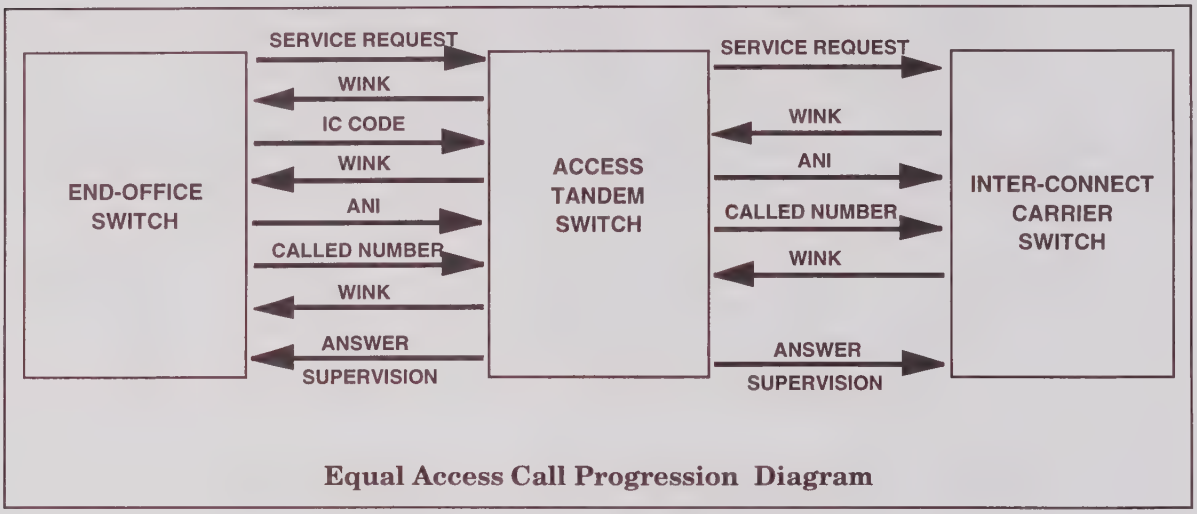
To build a Feature Group D (Equal Access) call from a Bell Operating Company (BOC) switch to an Interconnect Carrier (IC) through an Access Tandem switch, press the **Dial/Ring** function key.

If a sequence has not been entered previously, you will see the following display:

If a sequence is showing, press the **CLR** key to remove any existing sequence to achieve the above display.

Press softkey 3 until **MF** is displayed.

There are two types of equal access sequences. The 3-stage sequence is found on the input side to the Access Tandem. The 2-stage is found on the output from the Access Tandem toward the Interconnect Carrier. Both are Wink Start trunk calls and the only difference is that the 3-stage includes the Interconnect Carrier's identity code in addition to the calling number (ANI) and the called number.



Equal Access Call Progression Diagram

The 3-stage call has the form:

WINK IC CODE WINK CALLING # CALLED # WINK

The 2-stage call has the form:

WINK CALLING # CALLED # WINK

To simulate these calls, enter the numbers to be dialed and store them sequentially into memory. Starting from a blank display, use the numeric keypad to enter the IC code, for example, **KP001777ST**. Press **KP**, then press **0 0 1 7 7 7** and finally, press **ST**.

This is only an *example* of an IC code for 930A functionality purposes. You must check the local codes in effect for your area for real applications.

The IC code example display is:

To store this sequence in location 10, for example, press the **STO** key, enter **10** from the numeric keypad and press **ENT**. Press **CLR** to clear the display, allowing for the entry of the next sequence.

The next step in creating the Equal Access call is to enter the calling number. In this example, the MF string for the ANI is **KP004087611000ST**. The first two digits are the information digit pair (for inter-LATA restricted lines), and then the 10 digit ANI number (calling number plus area code). The MF delimiters **KP** and **ST** surround the number.

Press **KP** on the numeric keypad, **0 0 4 0 8 7 6 1 1 0 0 0** and finally, press **ST**. If you have correctly entered the ANI, the display will look like:

To store this sequence in location **11**, for example, press **STO** and **ENT**. The 930A automatically increments the register location from **10** in the previous example. It is not necessary to enter the number **11**. Press **CLR** to clear the display, allowing for the entry of the next sequence.

The final string is the called number (with area code). For this example, we used the number **4155551212**. The MF delimiters **KP** and **ST** surround the number.

Press **KP** on the numeric keypad, **4 1 5 5 5 5 1 2 1 2** and finally, press **ST**. If you have correctly entered the called number, the display will look like:

To store this sequence in location 12, for example, press **STO** and **ENT**.

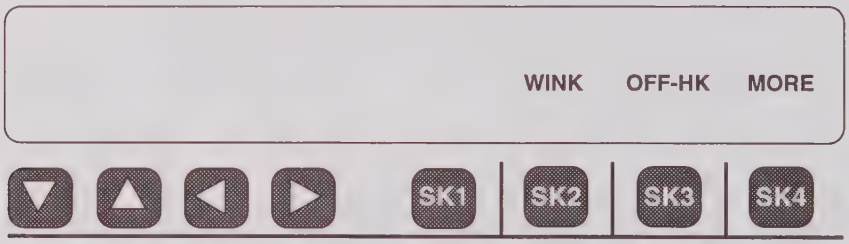
6-2.2 Set-up

To set this menu to send the Equal Access call after completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **2** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

If you press softkey 2 under **YES**, the 930A will continuously repeat sending the sequence entered.

If you press softkey 4 under **NO**, the 930A will only send the sequence once.

With either keypress, the 930A screen will become:



If a previous test sequence is present, press **CLR** and the display will show the same as above.

> *A Feature Group D input to an Access Tandem consists of the IC Code number, the ANI or calling number, and the called number, separated by wink supervision at the appropriate points.*

To input the sequence into the previous display, press softkey 2 under **WINK** to instruct the 930A to wait for a wink before outpulsing. Press **10** from the numeric keypad and press **ENT**. This tells the 930A to send the IC code digits previously stored in register 10 after it sees the wink.

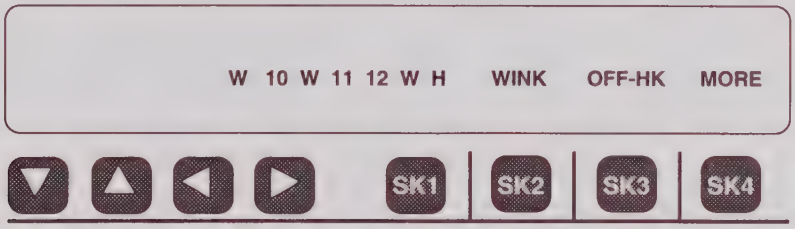
> *If the 930A is **PCM, CLEAR CHANNEL** mode, pressing softkey 2 under **WINK** will display **NOT AVAILABLE IN DRY OR CCIS TRUNK TYPES**. To deselect **CLEAR CHANNEL**, see **Section 5, PCM Operation** for set-up information.*

Press Softkey 2 again to tell the 930A to wait for another Wink between the IC Code number and the rest of the numbers. The 930A will then wait for the second wink. Repeat the process to have the 930A send storage location 11, wait for a Wink, and send storage location 12.

Press softkey 2 to tell the 930A to look for the final wink which completes the sequence.

Press softkey 3 to tell the 930A to expect the far-end to go off-hook when the call completes.

When you have correctly built the call sequence into the 930A, the display will look like:



where **10 = KP001777ST**, **11 = KP00408761000ST**, and **12 = KP4155551212ST**, in this example.

To send the call sequence, go off-hook using the front panel hookswitch and the 930A will start sending when it gets a wink from the far-end. If the 930A is already off-hook, go back on-hook and then go off-hook again and the sequence will be outpulsed. You will hear the outpulsing digit strings on the 930A's speaker and you should also hear the far-end answer. The 930A will also automatically time the winks. See **Section 6-9, Option Menu #: 9 Wink Timing** for more information.

You can either send a multi-wink sequence from the 930A or receive a multi-wink sequence but you cannot do both simultaneously from one 930A. A single 930A cannot simulate the originating and terminating offices simultaneously.

> *Any modifications made in* ***OPTION MENU #: 1 MODIFY DIAL/RING*** *will also be stored. Make sure that the correct Trunk Type has been selected before storing any strings.*

6-2.2.1 Example: Wink Start Trunks

To examine the procedure for originating a wink start call, first store the desired phone number in one of the memory locations (**01** to **998**) under the **Dial/Ring** function key. Press the **Dial/Ring** function key. The following is a typical example:

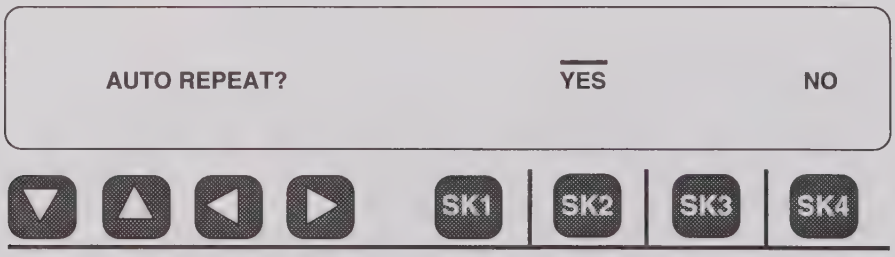
To send the DTMF digits called for in this example, press softkey 3 until the display shows:

Enter the telephone number to be called using the keypad. The 930A's hookswitch must be in the **On Hook** position. After entering a number, a typical display is:

To store the number in register location 20, for example press the **STO** key, enter **20** from the keypad, and press the **ENT** key. The 930A display will return to the above display.

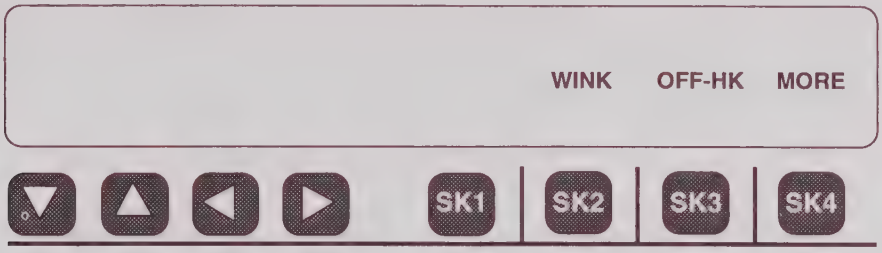
Return to **OPTION MENU #:2 SEND DIGIT SEQUENCES**.

Press any softkey under the display to see:



Select softkey 2 under **YES** to have the 930A continuously repeat outpulsing the sequence after going off-hook. Press softkey 4 under **NO** to have the 930A outpulse the sequence only once.

Pressing either softkey causes the 930A display to become:



Press **CLR** to clear any previous input. To program the 930A to wait for a wink before outpulsing, press softkey 2 under **WINK** and the 930A display will become:

Enter the location of the memory register from where the phone number is to be outpulsed. In this example, the number to be outpulsed after the wink was stored in memory location 20. Press **20** on the numeric keypad and press the **ENT** key. The 930A display will become:

An off-hook indication can be inserted at the end of the sequence to look at answer-back supervision.

Press softkey 3 under **OFF-HK** and the display will change to:

To outpulse the telephone number then, all that is required is to place the front panel hookswitch in the **Off Hook** position and the 930A will seize the trunk, wait for a wink and then outpulse the digits after the wink.

6-2.3 Sending a Call More Than 18 Digits Long

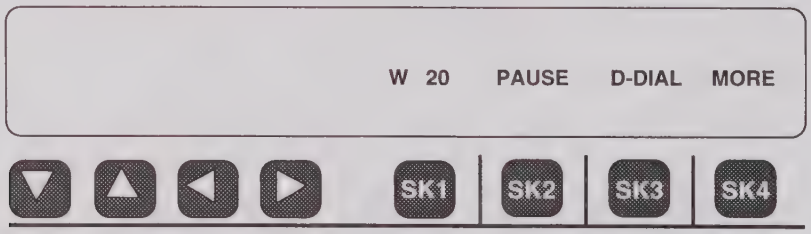
For this example, suppose you want to send a string of 30 DTMF 6s. To send 18 digits (the maximum parameter) from the **Dial/Ring** function key, select the **Dial/Ring** function key, choose **DTMF** mode, and enter eighteen 6s. Then store this string in register 1. Press **STO**, **1**, **ENT.** Next, clear out this display and enter twelve 6s and store them in register 2. Press **STO** and then **ENT**. (It is not necessary to press **2**; the 930A automatically advances to the next available storage location.)

Press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **2** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. Clear out any previous sequences. Enter the number **1**, press **ENT**, enter the number **2**, press **ENT**, and the display will be:

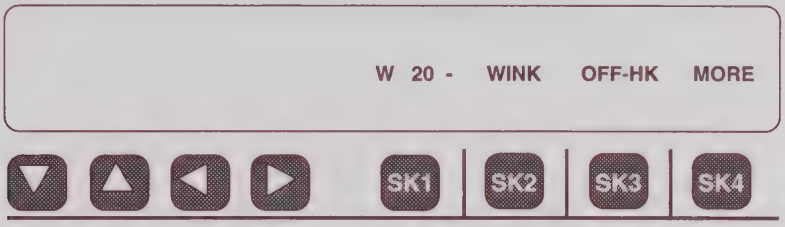
Go off-hook. To send up to 72 digits, you must store up to 18 digits in each of four successive memories (1, 2, 3 and 4) . **OPTION MENU #:2** may also be used to send a mixture of MF, DTMF or DP digits.

6-2.4 Additional Features

Press softkey 4 under **MORE**. The 930A display will advance to:



From this menu you can enter a pause by pressing softkey 2 under **PAUSE** and the 930A display will change to:



The digits stored in location 20 will be sent after going off-hook and receiving a wink. The 930A will then pause for one second after outpulsing. Instead of entering a pause, a delay-dial (**D-DIAL**) event could be inserted by pressing softkey 3.

Press softkey 4 under **MORE** again, instead of entering a pause or delay-dial, to display the following choices:

Press softkey 2 under **SEND** to send the sequence without first going off-hook.

Press softkey 3 under **TESTLINE** to choose a testline or wait for a call progress event (ringing, busy, etc.). This function causes the 930A to act as a Remote Office Test Line (ROTL)/Near End Responder at the end of the sequence. *Purchased Options 930A-01, Digit Receiver* and *-12 , ROTL/Responder* are required for this to function. The display looks like:

Select softkey 1 under **CPROG** (call progress) for example. The display will advance to:

The display will read **T2** *for a 102 test line,* **T5** *for a 105 test line or* **T1** *for a 125 test line.*

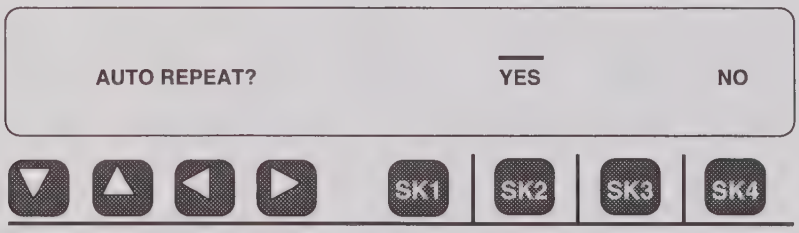
CP (call progress) will allow a call progress tone to gate the next sequence, such as a test line (**T1** in the above example). If dialing a ROTL test line, the 930A goes off-hook. The number of the far-end test line will be outpulsed after the wink is received. When the call completes and the test line answers with the Test Progress Tones, the 930A will begin testing. The results of the two-way measurements will be displayed. The results are stored in memory and may be reviewed in **OPTION MENU #: 26 ROTL/RESPONDER**.

6-2.4.1 Example: ROTL/Responder Testing Using Send Digit Sequences

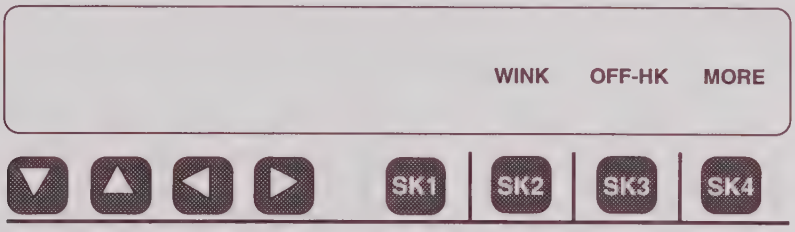
Purchased Option 930A-12, ROTL/Responder also enables operation of the manual ROTL test function from **OPTION MENU #: 2 SEND DIGIT SEQUENCES**. This enables the insertion of Winks or place a Multi-Wink type call to initiate ROTL testing.

First, set-up the ROTL/RESPONDER in **Option Menu #: 26** as described in **Section 6-26, Option Menu #: 26 ROTL/Responder**. This selects the TLP and tests which are desired. *Purchased Option 930A-12, ROTL/Responder* must be installed for **OPTION MENU #:26** to function. With this option installed, you have the choice of sending the far-end responder's number from the ROTL/Responder or sending from **OPTION MENU #: 2 SEND DIGIT SEQUENCES**. To place the call to the far-end responder from the Send Digit Sequences menu, begin at **OPTION MENU #: 2 SEND DIGIT SEQUENCES**.

Press any softkey under the display:



Press softkey 4 under **NO** to send the call sequence once and the display changes to:



If any previously entered sequences are displayed, press the **CLR** key.

As an example, simulate an Equal Access call sequence. This sequence will consist of two MF records: the ANI or calling number, and the called number which will be the test line's number. For this example, these two numbers are stored in memory locations 15 and 16.

After the winks and the two numbers have been correctly entered, the 930A display will look like the following:

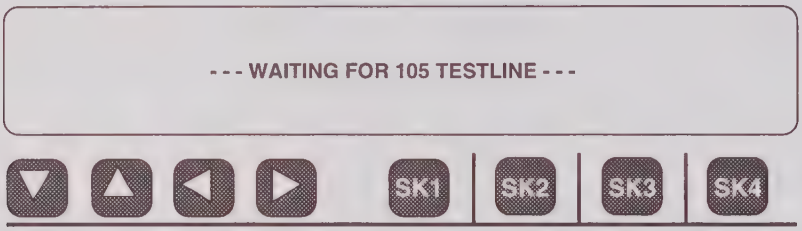
After entering the Feature Group D call sequence, the next step is to tell the 930A to become a manual ROTL/Near-end Responder so that it will commence testing after the call completes. Press softkey 4 under **MORE** until the 930A display looks like:

Place the ROTL function at the end of the sequence by pressing softkey 3 under **TESTLINE**. The 930A display will become:

Press softkey 3 under **105**.

The display will become:

To begin testing, place the front panel hookswitch in the off-hook position and the 930A will outpulse the call. The 930A display will appear as follows until the call completes and testing begins:



When testing commences, the two-way test results will appear. Press the **Option Menu** function key to discontinue testing.

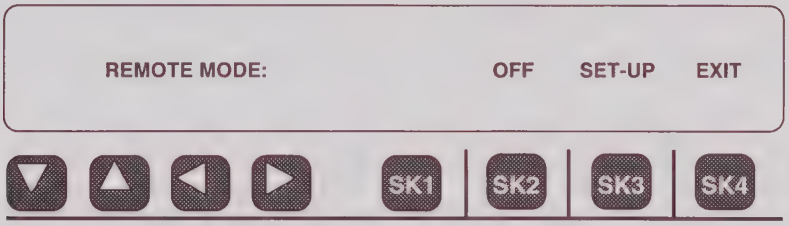
6-3 OPTION MENU #: 3 REMOTE CONTROL

The following is the general set-up procedure for remote control operation. For detailed information on remote control, see **Section 7, Remote Control Operation**.

Set-up the correct Trunk Type and any test functions desired. See **Section 3, Function Key Operation** for Trunk Type set-up information.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **3** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

Set the mode to **OFF** by pressing softkey 2 until **OFF** is displayed.



Press softkey 3 under **SET-UP** to see:

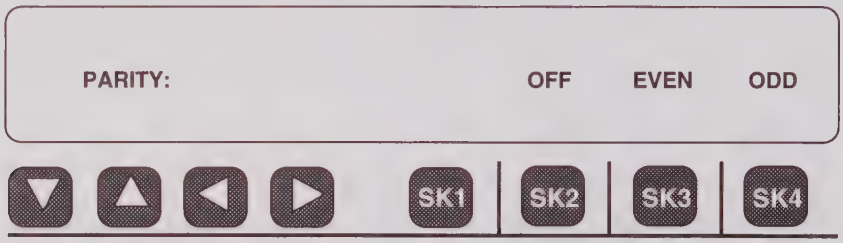
6-3.1 Baud Rate

To change the baud rate, press softkey 1 to see:

The valid range is from **300** to **38400**. The default value is **9600** baud. Use the numeric keypad to enter your selection. Press **ENT** or any softkey to exit this display. You will be returned to the **SELECT** menu.

6-3.2 Parity

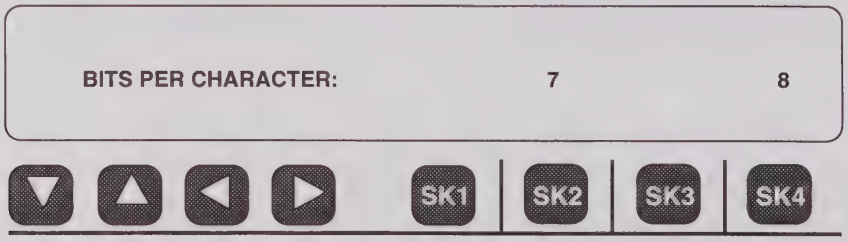
To change the parity, press softkey 2 to see:



The default parity is **EVEN**. Press softkey 2 under **OFF** for no parity. Press softkey 3 for **EVEN** parity. Press softkey 4 for **ODD** parity. The 930A will revert to the **SELECT** menu.

6-3.3 Bit Number

To change the data format, press softkey 3 under **BIT#** to see:



The 930A supports ASCII data formats of 7 or 8 bits length. The default format is 7 bits per character. Some printers and terminals treat characters with bit 8 used as graphics characters.

Press softkey 2 to select **7** bits or softkey 4 to select **8** bits. The display will advance to:

The default stop bit value is **1**. Press softkey 2 to select **1** stop bit. Press softkey 3 to select **1-1/2** stop bits. Press softkey 4 to select **2** stop bits.

The 930A will return to the **SELECT** menu. Press softkey 4 to exit this display and return to the main **SET-UP** menu.

Press softkey 2 to scroll through the different remote modes. The following modes are listed:

OFF	Manual control (no remote control)
TERMINAL	For use with dumb terminals
MASTER	For future use
SLAVE	For future use
ATR	For future use
COMPUTER	For use under computer control
PRINTER	Used to drive a printer connected to the RS-232 serial port.

After selecting a remote mode, pressing softkey 1 puts the 930A into **STANDBY MODE**. **REMOTE MODE** and **STANDBY MODE** will alternately flash on the screen until softkey 1 is depressed again, releasing **STANDBY MODE**. Use **STANDBY MODE** to operate the 930A manually without losing remote access capability.

The above modes are explained in detail in **Section 7, Remote Control Operation**.

6-4 OPTION MENU #: 4 DIGIT RECEIVER

The 930A digit receiver is equipped with two Option Menu Numbers when *Purchased Option 930A-01, Digit Receiver* is installed. They are:

1) **OPTION MENU #: 4 DIGIT RECEIVER**
2) **OPTION MENU #: 12 WINK MARGINING**

The digit receiver option can be used in **BRIDGE** mode on analog trunks, or the **MON-1** or **MON-1&2** modes on PCM trunks to monitor the interaction between equipment. In **TERM** (terminate) mode, the 930A can completely simulate terminating equipment. In either case, the 930A will record the outpulsed digits it receives. In **TERM** mode, the 930A will supply supervision. In the **BRIDGE** or **MON-1/MON-1&2** modes, it will look for, and time, supervision events (Winks, off-hooks, etc.). The 930A breaks an outpulsing sequence into groups of digits and supervision events. The digit groups, which can be MF, DTMF, or DP sequences, are called **RECORDS**. The supervision events are divided into winks, delays, and off-hooks.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. You may press the Up/Down arrow keys to scroll through the option menus, or you may select **4** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

Press any softkey under the display to enter the menu. The main menu is shown below:

6-4.1 Set-up

Press softkey 1 under **SET-UP** to enter the set-up menu for the digit receiver:

6-4.1.1 Parameters

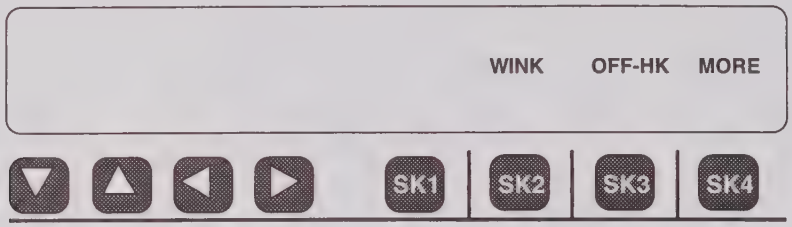
To set the **PARAMETERS**, you have to know whether the signaling on your trunk is Multi-Frequency (MF), Touchtone® (DTMF), or Dial Pulse (DP). You will need to know how many digits are in the call if using DP or DTMF. Press softkey 1 to see:

The digits in this case are MF digits. The 930A treats each incoming call as a **RECORD**. If the call is MF, you will need to tell the 930A the length of each called number.

The valid range is from **1** to **18** digits. Once you have set the **PARAMETERS** for the type of call you want to receive, press softkey 4 under **EXIT** to return to the main menu.

6-4.1.2 Sequence

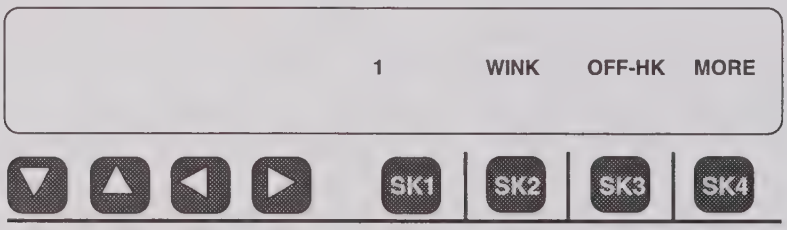
To set the **SEQUENCE**, press softkey 3. The 930A default display is shown below:



For a Wink Start trunk, press softkey 2 under **WINK**.

The **W** appears. This tells the 930A to give the far-end a wink when it sees the trunk being seized. To follow the above example, enter the number **1** to tell the 930A to receive a single record (since this is a regular domestic call example) from the far-end. If in **TERMINATE** mode, enter an **OFF-HK** so that answer supervision may be returned and timed. This is done by pressing softkey 3 under **OFF-HK.** An **H** appears after the **W 1**. If not in **TERMINATE** mode, it is not required to enter the **H**.

For the Immediate Start trunk, there are no winks involved. Enter a **1** from the keypad and press **ENT**.



Press softkey 3 under **OFF-HK** to send back an off-hook when terminating a trunk.

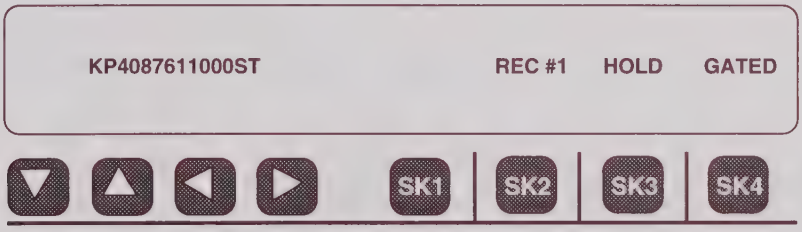
On a Ground Start trunk, start with an off-hook. If in **TERM** mode, enter the **H** first and then the **1**. If not in **TERM** mode, an off-hook is not required.

After entering the sequence into the 930A, press the **Option Menu** function key to return to the main **SET RECEIVE** display. Press Softkey 4 under **EXIT** and the 930A display will back out another step to the main selection menu.

6-4.2 Receive

To activate the digit receiver, press softkey 2 under **RECEIVE** from the main menu to see:

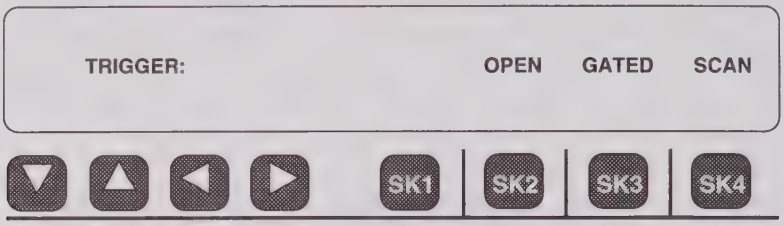
The next time the trunk is seized and digits are sent, the 930A will display the digits. An example might look like:



Press softkey 2 to scroll through the available records.

Press softkey 3 to **HOLD** the captured digits. The digits will remain in the display until softkey 3 under **HOLD** is pressed again.

Press softkey 4 under **GATED** to see:



Press softkey 2 to activate **OPEN** mode. **OPEN** mode will receive digits regardless of the supervision state.

Press softkey 3 to activate **GATED** mode. **GATED** mode waits for an on–to–off-hook transition before the digit receiver is activated.

SCAN mode is available only in PCM and is selected via softkey 4. **SCAN** mode scans all 24 PCM channels until it sees one channel go off-hook and will collect digits from that channel. The 930A will continue monitoring the active channel until it goes back on-hook, or until the digit records are full. This mode automatically scans the next call until softkey 4 is pressed again, discontinuing the function.

Once the digits have been received, press the **Option Menu** function key to return to the main display.

6-4.3 Analyze

Press softkey 3 under **ANALYZE** to review the characteristics of each digit in the received string. A sample display appears below:

In the above example, an MF record has been received. The cursor is over the first digit, in this case, **KP**. By pressing softkey 2, you can page through the levels and frequencies of the two tones which make up the **KP** as well as their **ON** and **OFF** times. Use the right arrow key to move the cursor to the next digit, and so on.

If multiple records have been stored, press softkey 4 to scroll through each record.

Press the **Option Menu** function key to back out of the **ANALYZE** display. From the main menu, exit entirely from this option, or go back into the **RECEIVER** display to collect more digits. Refer to **Section 7, Remote Control Operation** for sending results to a computer or printer.

6-4.4 Sample Applications

6-4.4.1 PBX or POTS Trunks

To monitor a call on a POTS trunk, select the **Trunk Type** function key and match the following display. Refer to **Section 3, Function Key Operation** for set-up information:

Connect the **T/R** jack of the 930A to the trunk access point. This is typically at the "66 Block" or DEMARC point. Use a 310-to-alligator clip test cord and clip onto the trunk without pulling the Bridging clips from the DEMARC.

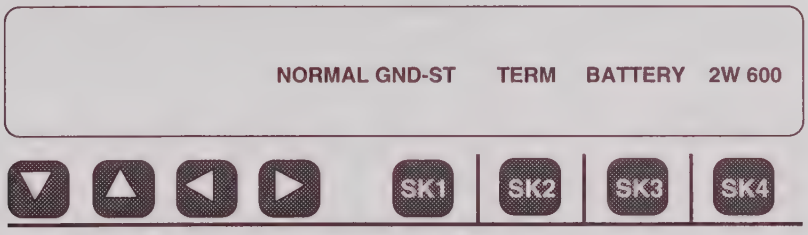
Before going to the **OPTION MENU #: 4 DIGIT RECEIVER**, check the front panel supervision LEDs. They should match the status of the trunk. That is, they should show **On Hook** on both **ORIG** and **TERM** if the trunk is idle. When the subscriber end goes off-hook to dial the call, the **ORIG** LED should show **Off Hook**. When the call completes, the **TERM** LED should go **Off Hook**.

If these states are reversed, set the Trunk Type to Reverse Loop. See **Section 3, Function Key Operation** and **Section 4, Analog Operation** for set-up information. The other settings remain the same.

Enter **OPTION MENU #: 4** and perform the steps outlined previously in this section.

6-4.4.2 PBX Ground Start Trunks

Select the **Trunk Type** function key and match the following display. Refer to **Section 3, Function Key Operation** for set-up information:



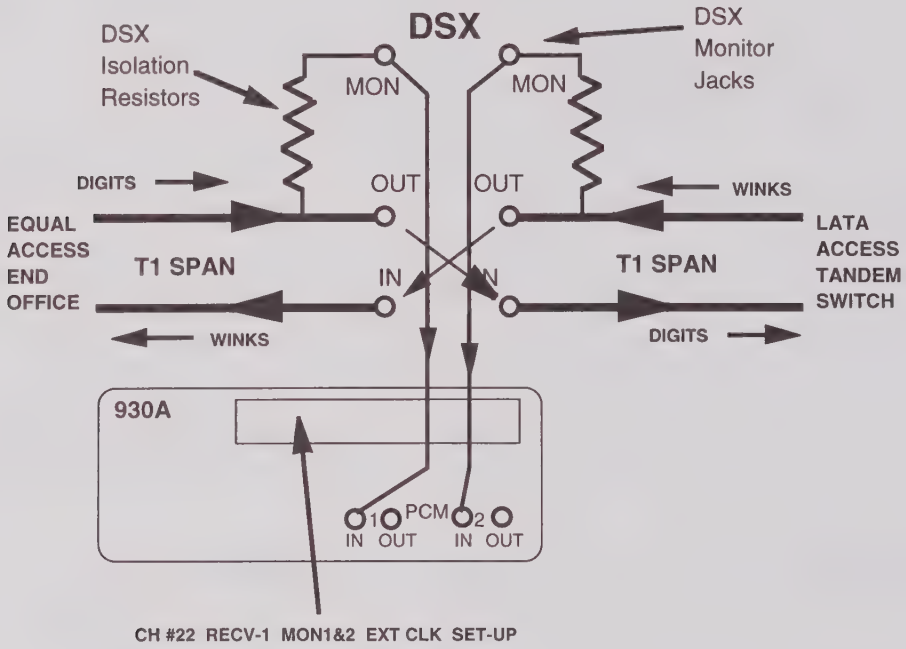
This is a 2-wire trunk. The test cord connection at the DEMARC is the same as described in **Section 6-4.4.1**, except the bridging clips have been pulled. The 930A will "look" toward the subscriber, simulate the Central Office and supply battery.

Once the test cord has been connected, check the front panel supervision LEDs to make sure they both show **On Hook** when the subscriber phone is on-hook. If not, you may have to change the Trunk Type to Reverse Ground Start. See **Section 3, Function Key Operation** and **Section 4, Analog Operation** for set-up information.

6-4.4.3 Equal Access Call Sequence on a T1 PCM Channel

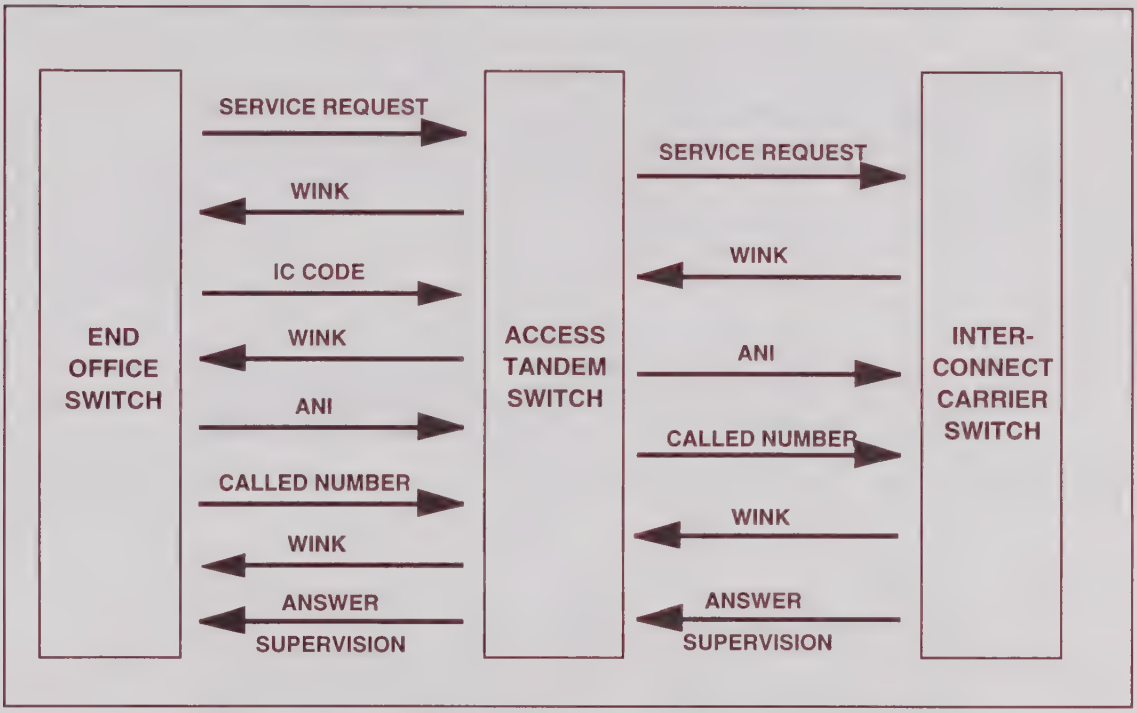
For this example, your 930A must be equipped with *Purchased Option 930A-01, Digit Receiver* and *-09E, Dual Drop/Insert w/ESF.*

Set-up the PCM Trunk Type to **MON1&2** on the 930A and connect it to the DSX Monitor jacks. Refer to **Section 5, PCM Operation** for set-up information. The test cords are connected from the 930A's PCM inputs 1&2 to the DSX Monitor jacks as shown below:



This diagram shows a Feature Group D call coming from the end-office into the Access Tandem with the 930A connected between the offices. **PCM 1 IN** (the RECV-1 side) through the monitor jack to the Equal Access end-office; digits come from the End Office. **PCM 2 IN** is connected through the monitor jack to the Access Tandem switch; winks come from the Access Tandem. The 930A is set to monitor both directions. Enter **OPTION MENU #: 4** and perform the steps outlined previously in this section.

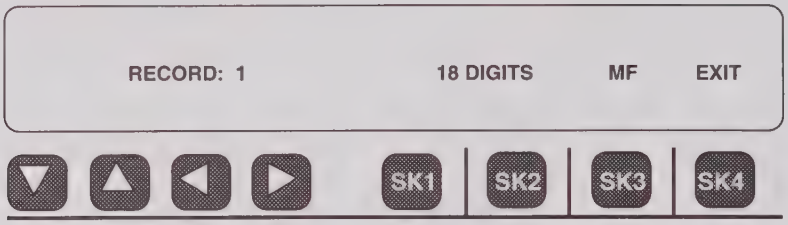
The following example illustrates Feature Group D Equal Access calls into an Access Tandem:

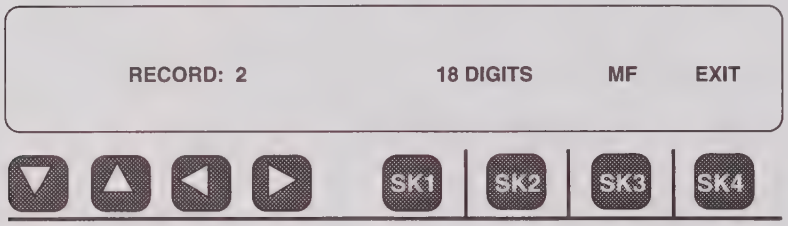


Going into the Access Tandem, the end-office supplies the customer's long distance, or Interconnect Carrier's code (to identify MCI®, AT&T®, SPRINT®, etc.), the number the customer is calling from (ANI), and the number the customer is calling. The call progression is: The end-office seizes the PCM Channel; the Access Tandem responds with a wink; the end -office sends the 6 digit IC Code; the Access Tandem gives a Wink after receiving the IC Code; The End Office sends the ANI followed by the called number; the Access Tandem gives a final Wink after receiving them; the far-end goes off-hook when the call completes.

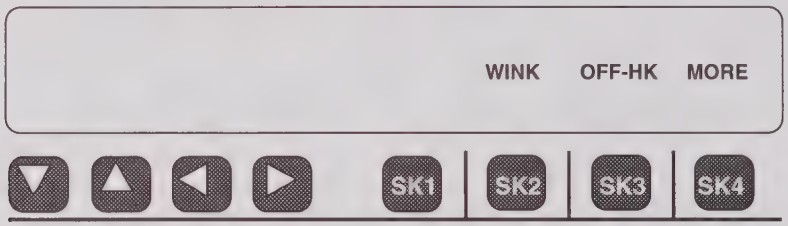
The 930A's **PARAMETERS** must be set to **MF** digits and each of the Records must be set to 18 digits in length.

The displays for Records 1 to 4 should all resemble the ones below:



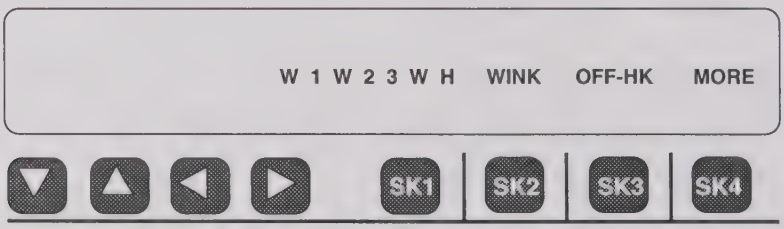


Press Softkey 4 to return to the **SET RECEIVE** menu. Enter the **SEQUENCE** menu shown below:



Begin by having the Receiver look for the Wink from the Tandem Office. The receiver should look for the IC Code followed by another Wink. The receiver should look for the ANI and the Called Number, followed by a Wink. All this can be reduced to a simple sequence of events. If there is a sequence displayed from a previous setting, press the **CLR** key. Press softkey 2 to enter the first Wink, then enter the number **1** for the first Record (IC Code), press Softkey 2 again for the second Wink, enter a **2** for Record 2 (the ANI), enter a **3** for Record 3 (the called number) and, finally, press softkey 2 for the final Wink.

If you add an **OFF-HK** at the end, the 930A display will look like the following:



The example receiver sequence above is set-up for a three-stage, multi-wink, Feature Group D call.

Press the **Option Menu** function key twice to return to the main menu and then press softkey 2 to select **RECEIVE**. Perform the steps outlined previously in this section.

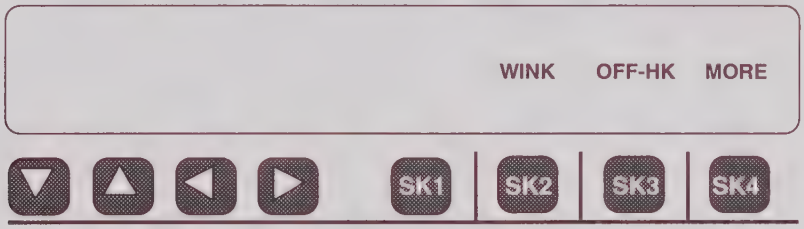
6-4.4.3.1 Example: Call Sequence

> *To set a TLP other than the default value of 0dB, you must first set the TLP in* ***OPTION MENU #: 25 FAR END RESPONDER*** *before setting up the Digit Receiver to act as a far-end responder.*

For this example, the 930A is a Type 105 far-end Responder after it receives a DTMF call on a wink-start Trunk. A single DTMF sequence on a wink start Trunk is expected. Press softkey 1 under **SET-UP.** Press softkey 1 under **PARAMETERS**. The display will show the previously entered settings. The 930A default display shows MF as the digits expected. Press softkey 3 under **MF** until **DTMF** appears.

Because this is a DTMF sequence, the correct length of the expected call must be entered or the 930A will wait for digits that will never come. A local call of 7 digits (no area code) length is used for this example. Press **7** from the numeric keypad and **ENT.** The display will read:

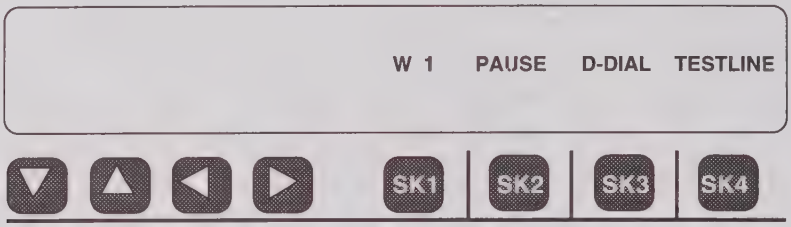
A single record is expected (this is not a multi-wink example). Press softkey 4 under **EXIT** to see the **SET RECEIVE** menu. Press softkey 3 under **SEQUENCE** to see:



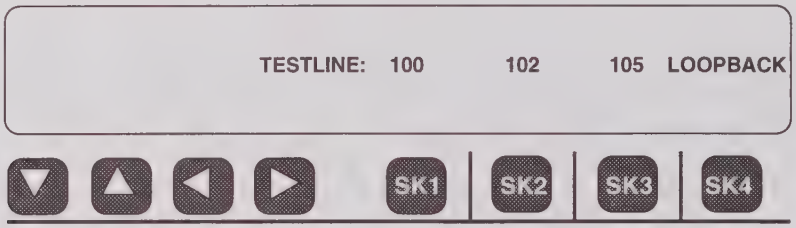
If there is a previously entered sequence present, press the **CLR** key. For this example, a Wink Start trunk was specified, meaning the 930A will provide the Wink because it is acting as a terminated receiver.

To enter a Wink into the sequence, press softkey 2 under **WINK.** After it gives the Wink, the 930A receives digits in digit Record 1, which was specified in the previous section. Press **1** on the numeric keypad and press **ENT** to see:

To have the 930A become a Type 105 Test Line after it receives the call, press softkey 4 labeled **MORE**:

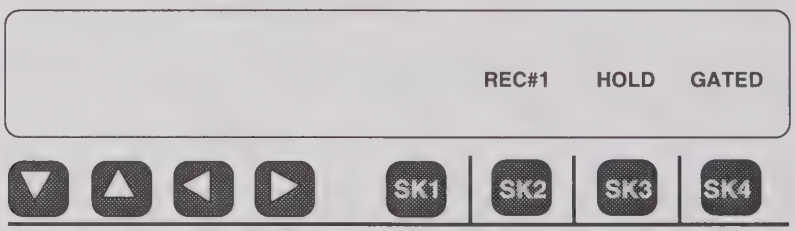


Press softkey 4 under **TESTLINE**:



To emulate a Type 105 Responder at the end of the received sequence, press softkey 3 under **105**:

The proper sequence has now been set-up. The last step is to place the 930A in the **RECEIVE** mode. Press the **Option Menu** function key to return to the **SET RECEIVE** menu. Press softkey 4 under **EXIT** or the **Option Menu** function key again to return to the main menu. Press softkey 2 under **RECEIVE** to select the Digit Receiver mode of operation. You will see:



When the 930A sees a seizure of the trunk it will respond with a Wink. Next, the 930A will expect to receive a digit string (DTMF digits in this example) which will be displayed across the screen.

After the digit string has been received the 930A will emulate a Type 105 Test Line until the distant end goes back on-hook or a key is pressed.

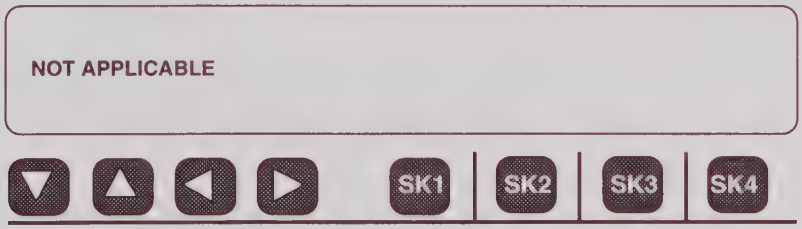
6-5 OPTION MENU #: 5 RING LOAD

THE RING GENERATOR CAN PRODUCE POTENTIALLY DANGEROUS VOLTAGE LEVELS. DO NOT TOUCH TEST LEADS WHILE THE GENERATOR IS OPERATING.

The 930A may be equipped with a Ring Generator and Ringer Equivalent Number 3 Load by installing *Purchased Option 930A-13, REN-3 LOAD*. This option provides a nominal sinewave ringing voltage of 87 Volts RMS at 20 Hz. This option also provides a true Ringer Equivalent Number 3 (REN-3) load to terminate ringing supplies. The Ring Generator is intended for operation on 2- and 4-wire Loop and Ground Start trunks.

6-5.1 Set-up

After completing the initial set-up of the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. You may press the Up/Down arrow keys to scroll through the option menus, or you may select **5** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If your 930A is in **BATTERY**, you will see the following screen:



The 930A must be set to **CONTACT** mode in the Trunk Type set-up. Refer to **Section 3, Function Key Operation** for Trunk Type set-up.

If the 930A is in **4W LOOP** or **4W GROUND START**, there is no display of the level and frequency of the ringing.

If the 930A is in **2W LOOP** or **2W GROUND START**, the 930A display will first appear as shown below when you press any softkey:

The REN-3 Load is not on-line (as shown by the cursor above **OUT**). To have the 930A act as a true REN-3 Load at its TR or T1R1 jacks, press softkey 4 under **IN**.

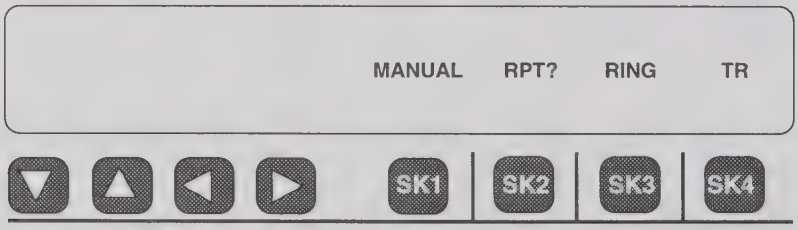
The 930A hookswitch must be in the **On Hook** position. When ringing is introduced into the 930A on a 2-wire trunk, the display will show the voltage level in RMS volts (**VRMS**) and the frequency in Hertz (**Hz**). With the load **IN**, a typical example might read **73 VRMS 19 HZ**. With the load **OUT**, a typical measurement might read **85 VRMS 19 HZ**. You must put the hookswitch in the **Off Hook** position to trip ringing. Softkey 2 or 3 moves the cursor back to **OUT**.

To adjust the ringing level, frequency or timing, select **OPTION MENU #: 1 MODIFY DIAL/RING**. Refer to **Section 6-1** for set-up instructions.

6-5.2 Sending Ringer Voltage

The sending 930A must be in **LOOP** or **GND-ST**, **TERM**, **BATTERY** and **2W**. Select the **Trunk Type** function key to check this set-up. See **Section 3, Function Key Operation** and **Section 4, Analog Operation** for set-up information.

Select the **Dial/Ring** function key. Press softkey 3 to display **RING**. The 930A hookswitch must be in the **Off Hook** position. To provide ringing, press softkey 1 under **MANUAL**.



If you press softkey 2 under **RPT?**, you will be simulating interrupted ringing.

The display will change to **RPT!** as shown below:

After tripping ring, press softkey 2 under **RPT!** to cycle ringing again..

You can leave **OPTION MENU #: 5 RING LOAD** at any time by pressing the **Option Menu** function key or any other function key. If you have selected **IN**, the 930A will put a 3 Ringer Equivalent load on the line while you make other measurements. The default condition for this Option is **OUT**, or off-line.

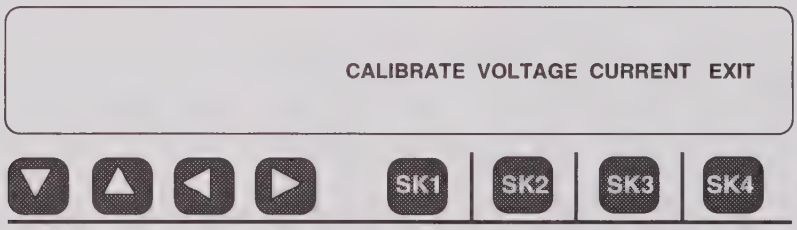
6-6 OPTION MENU #: 6 DC VOLT/AMP METER

This option provides DC voltage and current measuring capability on metallic (analog) trunks. This function is useful for determining the levels of supervision voltages and applying the information towards setting thresholds in **OPTION MENU #: 7 SUPERVISION THRESHOLDS**.

You can measure the DC voltage from Tip-to-Ground, Ring-to-Ground, and Ring-to-Tip on 2-wire Loop and 2-wire Ground-Start trunks. The DC voltage from TR-to-Ground, T1R1-to-Ground and TR-to-T1R1 may be measured on 4-wire Loop and 4-wire Ground-Start trunks. On E&M trunks, you can measure the DC voltage from E-to-Ground and M-to-Ground. All voltage readings are printed as signed values to the nearest volt. This feature may be used in either **TERM** or **BRIDGE** mode.

6-6.1 Loop and Ground Start Measurements

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **6** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. You will see:



6-6.1.1 Calibrate

Press the softkey under the measurement you wish to make, or press softkey 1 under **CALIBRATE** to force the 930A calibrate itself prior to making a measurement. You will see the message **PLEASE UNPLUG CABLES FOR CALIBRATION**. This message will change to **PRESS ANY SOFT KEY TO CALIBRATE**. Remove any cables connected to the 930A front panel and press any softkey to continue.

If calibration is not successful, the display will read **CAL FAILED -- CHECK FOR VOLTAGE ON LINE.**

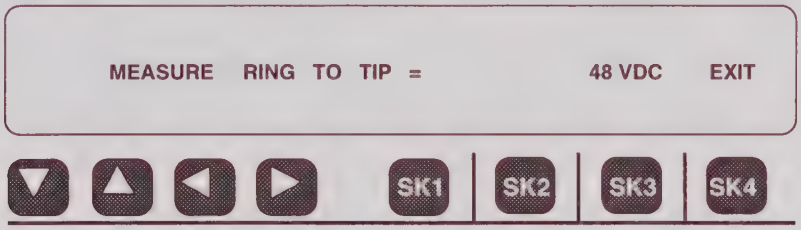
6-6.1.2 Current

After calibration is complete, plug the test cords back in and press softkey 3 under **CURRENT** in the main menu. The loop current measurement will be displayed. A typical display would look like:

Error messages are provided if you try to measure a parameter with an incorrectly set-up Trunk Type. Press softkey 4 under **EXIT** to return to the main set-up menu.

6-6.1.3 Voltage

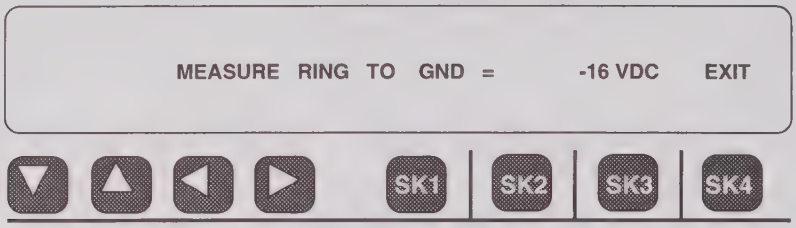
To measure DC voltage, press softkey 2 under **VOLTAGE** and you will see a display measuring Tip-to-Ground (**TIP TO GND**). To measure the voltages from Ring-to-Ground (**RING TO GND**) and Tip-to-Ground (**TIP TO GND**) under on- and off-hook states, press softkey 1 and the display will scroll to the next state. An on-hook example may be:



An off-hook example might look like:

If the contact side goes off-hook, a lower reading will be expected as current is drawn through the loop and voltage drops occur. After the contact side goes off-hook, typical Ring-to-Tip voltage readings are less than -45 volts.

An example of a typical Ring-to-Ground measurement if the contact side goes off-hook is shown below:



Pressing softkey 1 advances the 930A to measuring the Tip-to-Ground voltages. An idle state (both sides on-hook) should give a **0 VDC** measurement. This is the proper indication for a Loop Start trunk in the idle state.

When the battery side goes off-hook, a typical measurement of Tip-to-Ground voltage would be **-48 VDC**. This indicates a battery reversal. Unless these or similar readings were obtained, there would be an indication of trouble in the loop supervision circuitry. Press softkey 4 under **EXIT** to return to the main menu.

The following table lists the range and accuracy of the various 2-wire and 4-wire DC Voltage measurements the 930A can make:

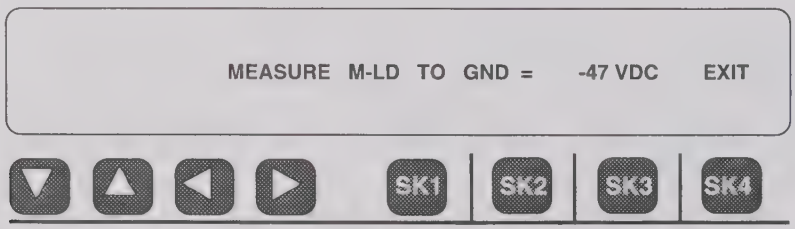
	RANGE	ACCURACY
Tip-to-Ring and TR-to-T1R1:	+60.0 to -60.0	+/- 3 volt
Tip-to-Ground and Ring-to-Ground:	+0.0 to -60.0	+/- 3 volt
TR-to-Ground and T1R1-to-Ground:	+0.0 to -60.0	+/- 3 volt

6-6.2 E&M Measurements

Select **E&M** in the Trunk Type set-up. See **Section 3, Function Key Operation** for set-up.

To make E&M measurements, follow the calibration instructions outlined in **Section 6-6.1.1**.

A typical E&M voltage reading is shown below:



The following table shows the range and accuracy of the E&M 2-wire and 4-wire DC Voltage measurements the 930A can make:

	RANGE	ACCURACY
M-to-Ground and E-to-Ground:	+0.0 to -100.0	+/- 3 volt

6-7 OPTION MENU #: 7 SUPERVISION THRESHOLDS

If expected voltages are not present, the supervision LEDs flicker or do not light at all. The threshold needs to be changed. If you have selected the correct Trunk Type for the 930A and connected it to the trunk under test and the LEDs do not indicate properly, check the voltages on the trunk with **OPTION MENU #: 6 DC VOLT/AMP METER**.

> *You cannot change the level of the supervision voltage which the 930A supplies as an output. This is fixed at 48 volts and ground.*

The choices presented in this option will vary, depending upon the current Trunk Type and which end of the circuit the 930A is on. In all cases, however, a series of screens are presented showing a voltage level, a description of the supervision state this represents, and a **DEFAULT** choice.

In all cases except the digit receiver, **ORIG** refers to the end of the circuit the 930A is on. If the 930A Trunk Type is set to **LOOP CONTACT**, for example, **ORIG Off Hook** means the contact side of the circuit is off-hook. If the 930A is providing battery, **ORIG Off Hook** means the battery side of the circuit is off-hook.

Voltage levels are printed as absolute values: **< 45V** does not mean "more negative" than -45 Volts. It means less than 45 Volts of potential. Values can be set to the nearest volt with an accuracy of +/- 0.5 VDC. Use **OPTION MENU #: 6 DC VOLT/AMP METER** to examine the current and voltage levels.

6-7.1 Supervision Threshold Ranges

Normal Loop Start Supervision

Voltages above 39 volts will cause an **On Hook** indication from the supervision lamps. Voltages above 3 VDC and below 39 VDC will cause an **Off Hook** indication. A reversal of -48 Volts and ground would indicate the battery side **Off Hook** . See **Section 6-7.2** for detailed set-up information.

Ground Start Supervision

Voltages on Ring above 33 volts indicate **On Hook** at the contact side. Voltages on Tip in excess of 33 volts indicate **On Hook** on the battery side.

E&M Supervision

Originating Eng (SEND-M) Indications.

The **ORIG** LED shows the status of the "M" lead. An **Off Hook** indication is provided if the voltage is above 39 volts. The LEDs will not be lit for voltages above 11 but below 39 volts. The LEDs indicate **On Hook** if the voltage is less than 11 volts. See **Section 6-7.3** for detailed set-up information.

The TERM LEDs show the status of the "E" lead. An **Off Hook** indication is provided if the voltage is below 11 volts. The LEDS will not be lit for voltages above 11 volts but below 39 volts. The LEDs show an **On Hook** if the voltage is above 39 volts. See **Section 6-7.3** for detailed set-up information.

Terminating End (SEND-E) Indications.

In this case, the **ORIG** LED shows the status of the "E" lead. An **Off Hook** indication is provided if the voltage is below 11 volts. The LEDS will not be lit for voltages above 11 volts but below 39 volts. The LEDs show an **On Hook** if the voltage is above 39 volts. See **Section 6-7.3** for detailed set-up information.

The TERM LEDs show the status of the "M" lead. An **Off Hook** indication is provided if the voltage is above 39 volts. The LEDs will not be lit for voltages above 11 but below 39 volts. The LEDs indicate **On Hook** if the voltage is less than 11 volts. See **Section 6-7.3** for detailed set-up information.

The following sections provide examples for setting Loop Start and E&M trunk supervision thresholds to accommodate 24 VDC supervision instead of the normal 48 volts.

6-7.2 Example: 24 VDC: Loop Supervision Thresholds

Set the 930A to **NORMAL LOOP CONTACT 2W 600** or **900** under the **Trunk Type** function key. See **Section 3, Function Key Operation** and **Section 4, Analog Operation** for set-up information. Press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **7** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. You will see:

The display above means that if there is no talk battery present ("dry" loop), there will be no voltage across the loop, and the 930A will turn off all supervision LEDs. This threshold is preset at 3 volts. For this example, this value will be adequate. Advance the display to the next choice by pressing either softkey 1, 2, or 3:

When the originate, or **CONTACT**, side of the circuit goes off-hook, it closes the loop between Tip and Ring (2-wire) or TR and T1R1 (4-wire). This lowers the voltage difference across the loop. On a short loop, or near the contact end of the circuit, this voltage will be very small. Near the battery (Central Office) end on a long loop, this voltage can remain fairly large. The 930A sees the **CONTACT** end as being off-hook when the voltage across the loop falls below 39 volts. If a PBX is being tested and it is powered from -24 volts instead of -48 volts, the threshold of the 930A should be set to about 20 volts.

To set the threshold to 20 volts, use the keypad to enter the number **20** and press the **ENT** key. This value will now be remembered by the 930A. Press softkey 4 under **DEFAULT** in the above display when you have finished testing or the readings will be incorrect when you go back to normal 48 Volt trunks. The default value is **39**.

If you set the Trunk Type to simulate the Central Office, or **BATTERY** end of the circuit, the display below will appear as a reminder:

The procedure for changing the threshold to 20 volts is the same.

The previous display explains that the 930A expects the battery (Central Office) side of a loop start circuit to provide -48 VDC on Ring (2-wire) or T1R1 (4-wire) in **NORMAL** mode. In **LOOP REVERSE**, the 930A expects to see -48 VDC on Tip (2-wire) or TR (4-wire). The 930A interprets this as the normal on-hook condition. A reversal from – to + is interpreted as the battery side of the circuit being off-hook. There is no voltage threshold.

After you have set the 930A to the **20 V** level, press the **Option Menu** function key to exit from this menu. If you press softkey 1, 2, or 3 instead of pressing the **Option Menu** function key, you will be asked to select whether you want the 60 Hz filter on or off:

If you are receiving Dial Pulse digits, press softkey 4 to turn this filter **OFF**. Otherwise, press softkey 3.

Essentially, **OPTION MENU #:7 SUPERVISION THRESHOLDS** enables you to adjust the supervision voltages so the front panel LED supervision indicators will read properly under unusual circumstances. This does not mean that the 930A will output other than -48 VDC supervision. It will recognize other voltages at its input.

6-7.3 24 VDC: E&M Supervision Thresholds

The various E&M Types (1 through 5) have different means of providing supervision battery to the "E" and "M" leads, but the end result is the same. In one supervision state the lead is held at -48 volts. In the other state it is held close to ground. The intermediate voltages are interpreted as "no indication" and the 930A turns off the appropriate LEDs.

For this example the 930A is assumed to be set to **E&M I SEND-M 4W** operation with a 24 VDC supervised trunk instead of the normal 48 VDC.

Upon entering **OPTION MENU #: 7 SUPERVISION THRESHOLDS**, the 930A display will be:

Since 24 volts is half of 48 volts, a good guess is to reduce everything displayed by half. For example, instead of 11 volts, enter **6** (which is roughly half) using the numeric keypad and pressing **ENT**.

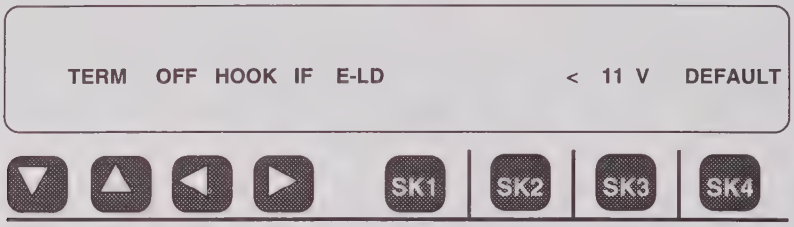
Next press either softkey 1, 2, or 3 and the display advances to:

In this case the 930A will provide an **Off Hook** indication on the **Orig** LEDs if the voltage on the "M" lead exceeds the **39 V** threshold. This value has to be changed to **20 V** (roughly half of 39). Enter **20** from the numeric keypad and press **ENT**.

Pressing softkey 1, 2, or 3 will advance the display to:

Here the 930A will provide no supervision indication if the voltage on the "E" lead is below the high threshold of **39 V** but above the low threshold of **11 V**. The high threshold can be changed to **20 V** as before.

Pressing softkey 1, 2, or 3 advances the display to:



An **Off Hook** indication on the front panel LEDs will be provided if the voltage on the "E" lead is below the **11 V** low threshold. This value must be changed to **6 V** in the same manner as the others.

When the thresholds have all been set, press the **Option Menu** function key to exit.

You must return to these displays after you are finished testing and reset them to their default values to avoid problems on normal circuits.

6-8 OPTION MENU #: 8 SUPERVISION MONITOR

This option gives the 930A the equivalent of a "strip chart recorder" function for timing events of long duration, as well as for timing supervision events such as Guard times, Ground Start timing and other events not covered by **OPTION MENU #: 9 WINK TIMING** (see **Section 6-9** for more information).

This option works on analog trunks as well as PCM trunks with the 930A terminating or monitoring the circuit (**BRIDGE** mode on analog trunks and **MONITOR** mode on PCM).

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **8** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

6-8.1 Analog Connections

6-8.1.1 Record

To record events in a time line format, press softkey 2 under **RECORD** and the 930A will record supervision events such as on-hooks and off-hooks. The first display is:

When enough data has been obtained, press softkey 4 under **EXIT** to return the 930A to the main menu and stop collecting data.

6-8.1.2 Analog: Review

The events captured in **RECORD** mode may now be reviewed by pressing softkey 3 under **REVIEW**. The display of the events varies according to the Trunk Type the 930A is set-up to emulate. The display follows the front panel supervision LEDs. Lowercase **o** and **t** indicate both the **Orig** (Originating) and **Term** (Terminating) sides of the circuit are **On Hook** . If uppercase **O** and **T** are displayed, both **Orig** and **Term** are **Off Hook** . The time is displayed as **minutes:seconds.milliseconds** up to **255:59.999**.

6-8.1.2.1 Example: Review

Suppose the 930A had been capturing events for a period of time. After stopping the data collection as previously described, the first displayed result is:

EVENT # 0: will always be displayed first. Press the Up arrow or any softkey to scroll through the rest of the results. When you have reached the end of the results, the softkeys and Up arrow will become inactive. Scroll down to previously viewed results via the Down arrow key. Press the Left arrow key to return to **EVENT #0**. Press the right arrow key to advance to the maximum recorded **EVENT #**, skipping all interim events.

The next event, for example, might be:

Here the **ORIG** end is off-hook (uppercase **O**) after 406 milliseconds and the **TERM** side is on-hook (lowercase **t**).

The display of **EVENT # 2:** might be:

Here, the **TERM** end has gone off-hook (uppercase **T**) after 1.636 seconds. The 930A can time up to 200 events or for up to 4 hours unless a printer is connected. In this case the 930A continuously dumps its buffer when full and records continuously. If the supervision on the line enters an undefined state (neither on-hook nor off-hook), the 930A will display it as undefined by showing a dash (–) instead of an upper or lower case character. An undefined state is shown below:

Only supervision events are shown. Tones, digits and speech are not captured by the supervision monitor.

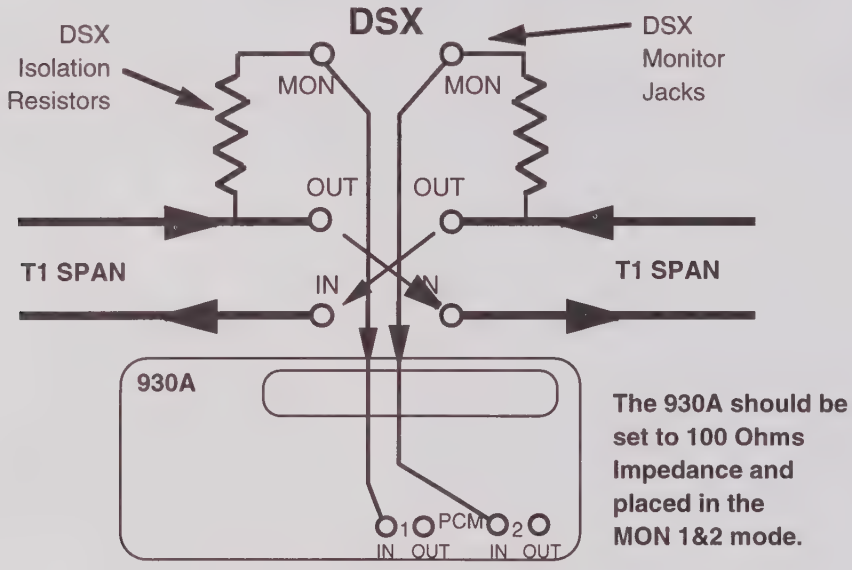
6-8.1.3 Monitoring Ground Start Supervision

Set-up the 930A to a Ground Start (**GND-ST**) Trunk Type under the **Trunk Type** function key. See **Section 3, Function Key Operation** for Trunk Type set-up. Return to **Option Menu #: 8** and record digits as explained in **Section 6-8.1.1**.

6-8.2 PCM Connections

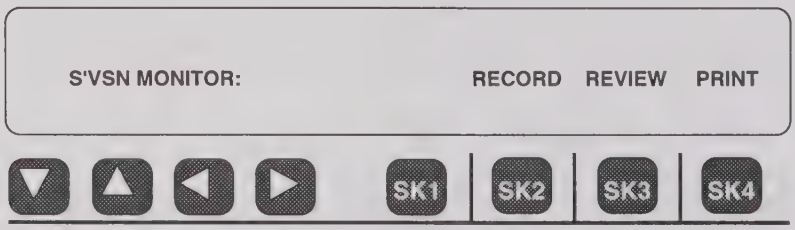
6-8.2.1 Measuring ABCD Bit Timing

The 930A gives you the capability to measure ABCD bits down to 1 millisecond accuracy. The following diagram shows this feature while looking in both directions:



PCM MODE: MONITOR 1&2

Set your 930A to **PCM MON-1&2** mode of the **Trunk Type** function key as described in **Section 5, PCM Operation**. Press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **8** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



6-8.2.2 PCM: Record

Press softkey 2 under **RECORD** and the 930A will start recording events. Follow the instruction outlined in **Section 6-8.1** before proceeding.

When you have recorded enough events (you can see the front panel supervision LEDs changing from **On** to **Off Hook**), press softkey 4 under **EXIT** to return to the main menu.

6-8.2.3 PCM: Review

To review the results, press softkey 3 under **REVIEW** and the first event will be shown.

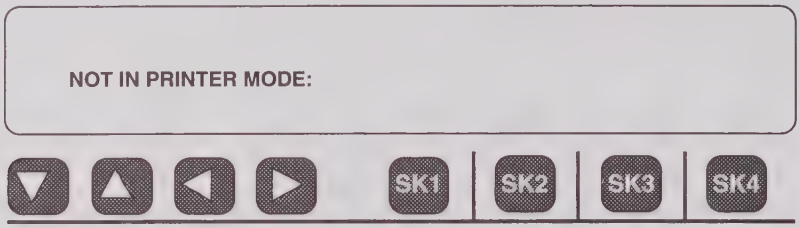
EVENT # 0: will always display first; this is usually an on-hook state as shown above. Press the Up arrow key or any softkey to scroll through the rest of the results. When you have reached the end of the results, the softkeys and Up arrow will become inactive. Scroll down to previously viewed results via the Down arrow key. Press the Left arrow key to return to **EVENT # 0**. Press the Right arrow key to advance to the maximum recorded **EVENT #**, skipping all interim events. Refer to **Section 4-6** for defining AB and ABCD bits.

The following are examples of possible events:

Press the **Option Menu** function key to exit this screen, or press it twice to return to the main screen.

6-8.3 Print

To print out the results to date, press softkey 3 under **PRINT.** If **PRINTER** mode has not been selected, the display will read:



The 930A will return to the main set-up menu. See **Section 6-3, Remote Control** for set-up instructions.

If in **PRINTER** mode, the display will read:

Press softkey 4 under **EXIT** to abort printing. When all records have been printed, the 930A returns to the main set-up menu

6-9 OPTION MENU #: 9 WINK TIMING

This option is used with, and is automatically set-up by, **OPTION MENU #: 2 SEND DIGIT SEQUENCES** or **OPTION MENU #: 4 DIGIT RECEIVER** (if *Purchased Option 930A-01, Digit Receiver* has been purchased). **OPTION MENU #: 9 WINK TIMING** enables timing of wink, pre-wink (guard time), and off-hook supervision events.

First, set-up a digit sequence in **OPTION MENU #: 2 SEND DIGIT SEQUENCES** or set-up the sequence to be received in **OPTION MENU #: 4 DIGIT RECEIVER**.

After you have outpulsed the call, measure the wink timing by pressing the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **9** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press any softkey to enter the option. The 930A will display the sequence as it was keyed-in under **OPTION MENU #: 2 SEND DIGIT SEQUENCES**. An example is:

A flashing cursor will appear over the last completed wink (**W**) or off-hook (**H**) in the sequence. If a wink or off-hook has failed, the cursor will appear over the failed event. If the sequence has not yet been outpulsed, the cursor will appear over the first supervision event and all measurements will be zero. There will be a measurement (**NNNN msec**) where **NNNN** is the length of time in milliseconds spent waiting for the event (the guard time). The word **GUARD** is displayed to label the measurement. This is the time from initial seizure to the beginning of the wink. If the guard time exceeds 16 seconds, the event "fails." In such a case the **GUARD** display would read **>16000 msec**, and the wink or off-hook measurement would read **FAILED**.

The left and right arrow keys move the cursor within the sequence to examine any supervision event.

Softkey 4 toggles between **GUARD** and **WINK** timing measurement (if the event is a Wink), or **GUARD** and **OFF HOOK** time measurement (if the event is an off-hook).

If the event is a wink, it fails if the period exceeds 600 msecs. If the event is an off-hook, it fails if this period is less than 200 msecs. You can also use Wink Timing to measure Delay Dial events as set-up in **Option Menu #: 2** or **Option Menu #: 4**. A Delay Dial event fails if the Guard period exceeds 16 seconds, or if the off-hook period exceeds 16 seconds.

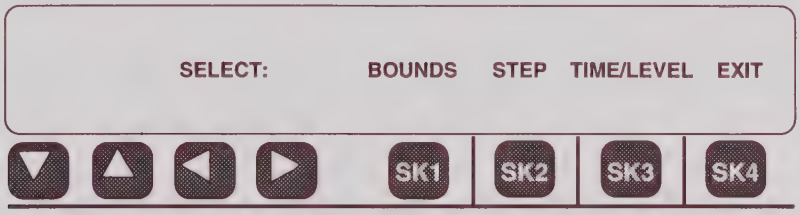
6-10 OPTION MENU #: 10 FREQUENCY SWEEP

This Option allows the 930A to sweep up or sweep down in frequency, either one time or continuously.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **10** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

6-10.1 Set-up

Press softkey 2 under **SET-UP** to change the default parameters of the voice band frequency sweep. The following is displayed below:



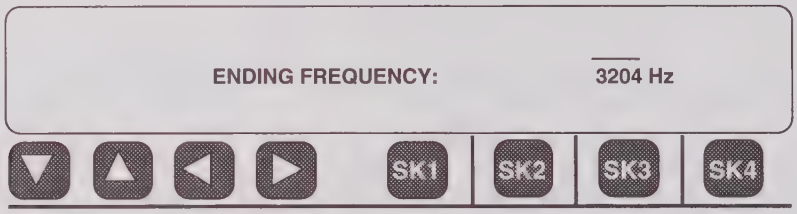
The 930A retains any previous set-ups. Previous set-ups are stored in this function unless a cold-boot has previously occurred.

6-10.1.1 Bounds

Press softkey 1 under **BOUNDS**. The following screen is displayed:

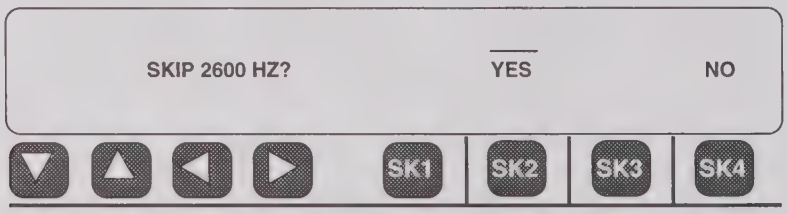
To change the starting frequency, enter the new frequency from the numeric keypad. The valid range is between **20 Hz** and **3904 Hz.** The default is **304 Hz**. Press any softkey or the **ENT** key.

The following screen is displayed:



*If you are using **OPTION MENU #: 17 ENVELOPE DELAY** in any Trunk Type, the maximum ending frequency is 3504 Hz. See **Section 6-17, Option Menu #: 17 Envelope Delay** for further information.*

The valid range is between **20 Hz** and **5000 Hz** for analog Trunk Types with a default of **3204 Hz**. The maximum ending frequency for PCM Trunk Types is **3904 Hz**. Enter the required frequency by the numeric keypad and press **ENT** . The following display will result:



Select the appropriate answer by pressing softkey 2. The 930A will return to the **SELECT** menu.

6-10.1.2 Step

From the **SELECT** menu, press softkey 2 under **STEP**. You will see:

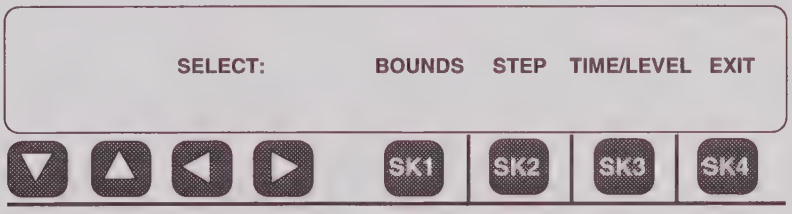
Enter the frequency required by using the numeric keypad then press **ENT**. The valid parameters are between **1 Hz** and **999 Hz** with a default of **100 Hz**. When complete, the screen will return to the **SELECT** menu.

6-10.1.3 Time/Level

From the **SELECT** menu, press softkey 3 to change the time between the steps or the level at which they are tested. The following screen will display:

Enter the required **TIME/LEVEL** change using the numeric keypad. The valid range is between **.1** and **9.9** seconds. The default time is **3.5** seconds. Press **ENT** or any advance to:

Enter the proper **LEVEL** using the numeric keypad. The valid range is between **-60.0 dBm** and **+12.0 dBm**. The default level is **-16.0 dBm**. Press any softkey or **ENT** when complete. The following screen will be displayed:



After completing the set-up for voice band sweep, press softkey 4 under **EXIT** to return to the main menu.

6-10.2 Sweep

Press softkey 3 to enter the **SWEEP** mode. The following screen is displayed:

The two choices are **MEASURE** and **SEND**. If you require a send only situation, press softkey 4 under **SEND**. If you require a measurement, press softkey 2 under **MEASURE** and you will display the measured frequency as you sweep on the transmit. The following screen is displayed below:

For continuous sweep, press softkey 2 under **CONTINUOUS**. Press the **Option Menu** function key to terminate **CONTINUOUS** mode.

To sweep only once, press softkey 4 under **SWEEP ONCE**. You will immediately hear the sweep tone, and the 930A will measure the received frequency as the sweep continues. (When the 930A has reached the frequency of approximately 15 kHz, you will no longer hear the audible tone in the speaker.)

In the **MEASURE** mode, this is the received level and frequency. The 930A will display the outgoing frequency and level if it is not in the **MEASURE** mode.

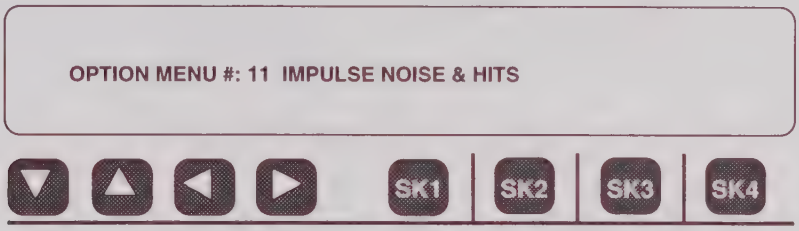
6-10.3 Frequency Sweep in Wideband

OPTION MENU #: 10 FREQUENCY SWEEP operation in Wideband is identical to voice band operation as described in **Section 6-10**, except as noted below:

Bounds: The valid range is between **20Hz** and **300 kHz,** with a default of **10000 Hz.**

Step Size: The valid range is between **1 Hz** and **20000 Hz**, with a default of **10000 Hz**.

6-11 OPTION MENU #: 11 IMPULSE NOISE & HITS



After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **11** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Pressing softkey 2 under **DEFAULT** will set the 930A to 4 dB spread and 7 measurements per second. The 930A will display **DEFAULTS SET** momentarily. The default threshold for PCM is 67 dBrnC. The default threshold for Analog is 54 dBrnC. If you want to measure with the default settings, press softkey 3 under **MEASURE** to go directly to the start screen beginning in **Section 6-11.2**.

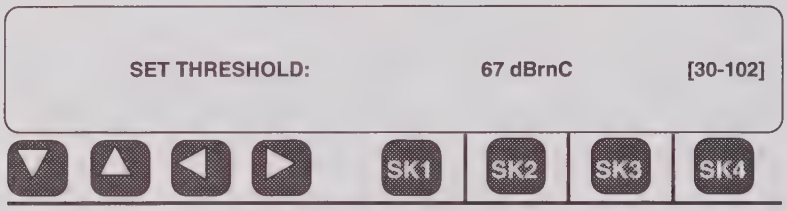
The default values for impulse noise measurement are taken from AT&T published specifications for short haul (less than 500 mile length) voice band data circuits.

6-11.1 Set-up

For a set-up other than the default specifications shown above, press softkey 4 under **SET-UP**. The following screen is displayed:

6-11.1.1 Threshold

To change any of the threshold parameters, press the appropriate softkey. For instance, to change the noise threshold, press softkey 1. The following screen is displayed:

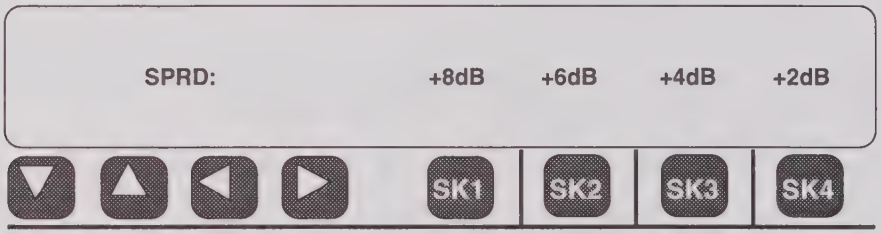


Enter the required threshold using the numeric keypad. After pressing any softkey, you will return to the second set-up screen.

> *The threshold range in voice band is* ***30-102 dBrnC.*** *The range in wideband is* ***50-99 dBrn.*** *See* ***Section 6-11.2*** *for more information on wideband operation.*

6-11.1.2 Spread

To change the spread or sample rate, press softkey 2 under **SPRD: N dB**:



> ***8 dB*** *spread is not available with thresholds above* ***96 dBrn****.*

After selecting the appropriate setting, you will be returned to the second set-up screen.

6-11.1.3 Measurements Per Second

Select softkey 3 and enter the desired **MEASUREMENTS PER SECOND** using the numeric keypad.

The range in voice band is **7-99.** *The range in wideband is* **5-99.** *See* ***Section 6-11.4*** *for more information on wideband operation.*

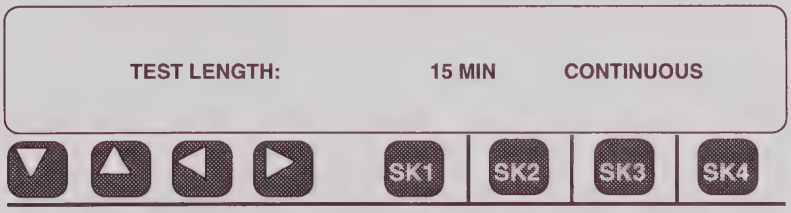
Press **ENT** or any softkey to return to the set-up screen.

6-11.1.4 More

Press softkey 4 under **MORE** to select the appropriate test length.

Press softkey 1 to enter the desired phase hit (**PH**) threshold and softkey 2 to enter the desired gain hit (**GH**) threshold. The valid phase hit threshold parameters are from **1°** to **45°**. The valid gain hit threshold parameters are from **1 dB** to **10 dB**. After making your selections, you will be returned to the threshold selection screen.

Press softkey 3 under **15 MIN** and you will see the following screen:



Press softkey 1 or 2 to select a measurement interval. The default is 15 minutes (**15 MIN**). The valid parameters are between 1 and 99 minutes. Press softkey 3 to select **CONTINUOUS** measurement. You will be returned to the threshold selection screen. Press **EXIT.** The 930A will proceed to the start screen below. (You will also reach this display by pressing softkey 3 under **MEASURE** in the main **IMPULSE/HITS** screen.)

6-11.2 Measure

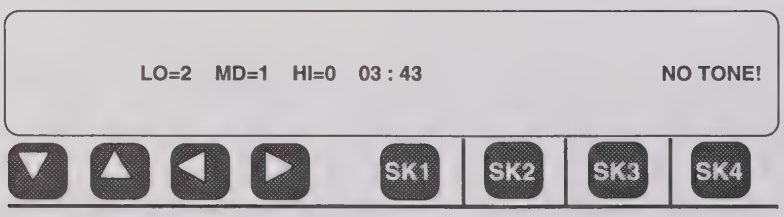
If you have selected the **DEFAULT** set-up and are ready to begin measuring, press softkey 3 under **MEASURE** from the **IMPULSE/HITS** screen. If you have completed the previous set-up instructions for non-default parameters, the following screen is displayed:

Press softkey 4 under **START** when you are ready to start testing. You will see the following screen:

This screen is only momentary and is replaced by the measurement screen below:

If you need to stop the test, press softkey 4 under **STOP**. Otherwise the test will accumulate impulse noise as selected under the **TEST LENGTH** screen. To exit, press the **Option Menu** function key.

If the test is to be performed with holding tone over a loopback circuit, the 930A should be set to send 1004 Hz at -13.0 dBm using the **Send Tone** function. If the holding tone drops below -40.0 dBm at any time during the test, the words **NO TONE!** will appear above softkey 4, as shown below:

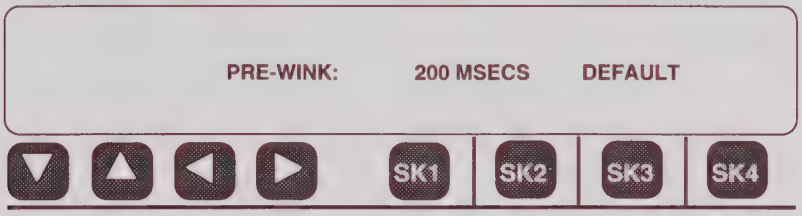


The default value of low threshold used by the 930A is 54 dBrnC0 which is the setting for voice frequency metallic cable facilities less than 500 miles in length. This threshold assumes the use of a -13 dBm0 holding tone.

6-12 OPTION MENU #: 12 WINK MARGINING

The 930A includes **WINK MARGINING** as part of *Purchased Option 930A-01, Digit Receiver.* **WINK MARGINING** lets you change the default of the length of time the 930A will wait (200 milliseconds) after it sees a seizure before it gives back a wink. This is called the pre-wink time or guard time.

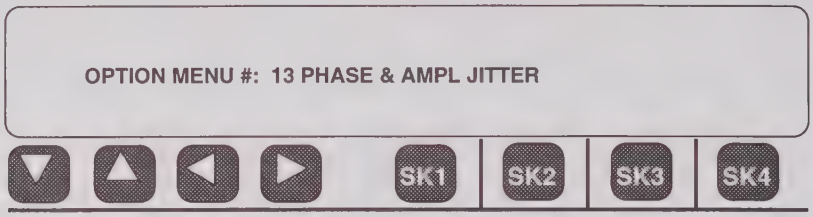
After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **12** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



The pre-wink time is the number of milliseconds the 930A will wait after line seizure (or the end of a record) before giving a wink. The valid range is between **75** and **999** milliseconds. The default value is **200 MSECS** with a resolution of 10 milliseconds and an accuracy of ±10 milliseconds. To change the displayed pre-wink time, enter the desired value from the numeric keypad and press **ENT**. If you want to keep the value that already exists, press **ENT** or any softkey. The display will advance to:

The above display shows the number of milliseconds the 930A will remain off-hook during a wink. The valid range is between **35** and **999** milliseconds. The default value is **150 MSECS**. The accuracy is ± 10 milliseconds and the resolution is 10 milliseconds. To change the displayed wink time, enter the desired value from the numeric keypad and press **ENT**. If you want to keep the default, press **ENT** or any softkey. Either action will exit to the Option Menu.

6-13 OPTION MENU #: 13 PHASE & AMPLITUDE JITTER



Purchased Option 930A-18, Phase/Amplitude Jitter works in conjunction with *Purchased Option 930A-07, Impulse Noise* to provide the capability to measure Phase and Amplitude Jitter on Voice Frequency channels as well as transient phenomena such as Phase Hits, Gain Hits, and Dropouts.

The Phase and Amplitude Jitter measurements are displayed under **OPTION MENU #: 13** and the Hits are counted with Impulse Noise under **OPTION MENU #: 11**.

Connect the 930A to the trunk under test prior to setting up these measurements. In the case of Phase Jitter measurements however, it is also necessary to perform a C-Message Noise measurement prior to measuring Phase Jitter. Excess noise can cause what appears to be significant amounts of jitter.

6-13.1 Measuring Phase/Amplitude Jitter

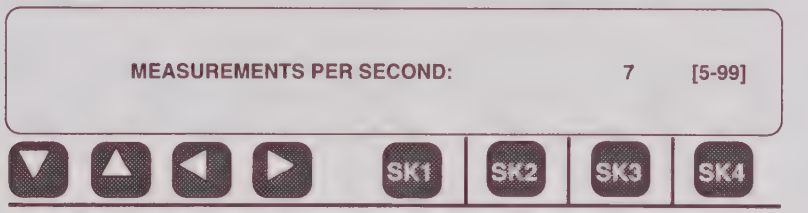
After making a C-Message noise test (readings should be less than 20 dBrnC for quiet terminated line), press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **13** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

Phase jitter requires a test signal of 1010 Hz. If the actual frequency of the test tone differs by more than ±20 Hz from the nominal value, or is below -40 dBm in level, the 930A will indicate **INVALID TONE.** See the display below:

To stop testing and return to the main menu, press the **OPTION MENU** key.

6-11.4.4 Measurements Per Second

Select softkey 3 and enter the desired **MEASUREMENTS PER SECOND** using the numeric keypad.



*The range in wideband is **5-99**. The range in voice band is **7-99**.*

Press **ENT** or any softkey to return to the set-up screen.

6-11.4.5 More

Press softkey 4 under **MORE** to select the appropriate **TEST LENGTH**.

Press softkey 1 or 2 to select a 15-minute (**15 MIN**) measurement interval. The default is 15 minutes (**15 MIN**). The valid parameters are between 1 and 99 minutes. Press softkey 3 to select **CONTINUOUS** measurement. If the cursor already highlights your selection, you may either press the softkey under that selection or press the softkey under **EXIT**. Either keypress will take you to the next screen:

Press softkey 4 under **START** when you are ready to start testing. In Wideband, it is not required that any tone be received in order to measure Impulse noise.

You will see the following screen:

This screen is only momentary and is replaced by the measurement screen below:

If you need to stop the test, press softkey 4 under **STOP**. Otherwise the test will accumulate Impulse noise as selected under the **TEST LENGTH** screen. To exit, press the **Option Menu** function key.

6-11.3 Phase Hits, Gain Hits and Dropouts

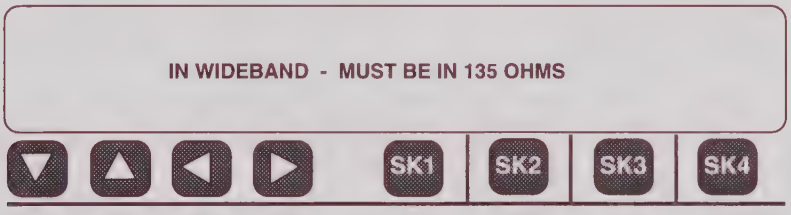
The measurement of the transients known as Phase Hits, Gain Hits, and Dropouts requires the 930A to be equipped with *Purchased Option 930A-07, 3-Level Impulse Noise* and *Purchased Option 930A-18, Phase/Amplitude Jitter.* These measurements are performed in conjunction with Impulse Noise measurement and are displayed as a sub-menu of the Impulse Noise display.

6-11.4 Impulse Noise & Hits in Wideband

OPTION MENU #: 11 Impulse Noise & Hits operation in Wideband differs in set-up and default parameters. For voice band operation, see **Section 6-11**.

Set-up the 930A for Wideband operation. See **Section 4-3, Wideband Operation** for set-up information. Press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **11** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

OPTION MENU #:11 IMPULSE NOISE & HITS tests in Wideband operate at 135 Ohms only. Any other termination selection will result in the following screen:



To change the Trunk Type to **135 OHMS**, select **WIDEBAND** from the **Trunk Type** function key. Change the termination impedances to 135 Ohms by pressing softkey 2 under **TR** or softkey 4 under **T1R1** and scrolling through the selections until **135** has been selected. Refer to **Section 4-3** for more information on Wideband set-up. Return to the Option Menu mode by pressing the **Option Menu** function key.

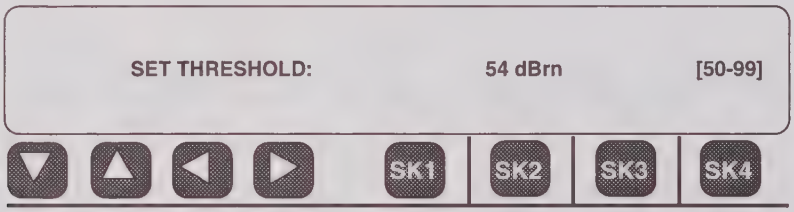
Press softkey 2 and the 930A will display **DEFAULTS SET** momentarily. The default settings are 54 dBrn threshold, 4 dB spread and 7 measurements per second. If a new set-up is required, press softkey 4 under **SET-UP.** The following screen is displayed:

6-11.4.1 Filter

To change any of the filters, press the appropriate softkey. If **C-NOTCH** is selected, refer to **Section 6-11** for voice band operation. In Wideband, phase hits and gain hits options are not available. If the cursor already highlights your selection, you may either press the softkey under that selection or press the softkey under **MORE**. Either keypress will take you to the next screen:

6-11.4.2 Threshold

To change any of the threshold parameters, press the appropriate softkey. To change the noise threshold, press softkey 1. The following screen is displayed:

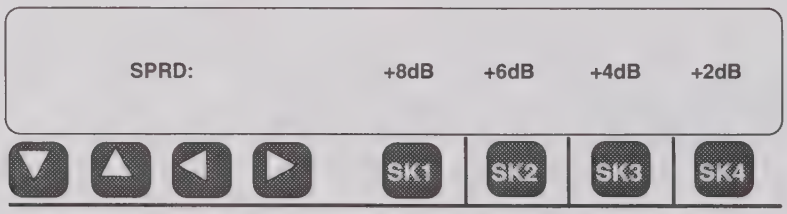


Enter the required threshold using the numeric keypad. After pressing **ENT** or any softkey, you will return to the second set-up screen.

> *The threshold range in wideband is* ***50-99 dBrn.*** *The range in voice band is* ***30-102 dBrnC.***

6-11.4.3 Spread

If you want to change the spread or sample rate, press softkey 2 under **SPRD: N dB** to see:



> ***8 dB*** *spread is not available with thresholds above* ***96 dBrn.***

After selecting the appropriate setting, you will be returned to the second set-up screen again.

If a tone is valid, the following screen will display:

The 930A begins measuring Phase and Amplitude Jitter over the filter bandwidth of 20 Hz to 300 Hz and displays the level and frequency of the received holding tone (usually 1004 Hz).

There is a good deal of Phase Jitter on the trunk in the above example. The full jitter measurement bandwidth (4-300 Hz) provides an overall picture of the jitter situation.

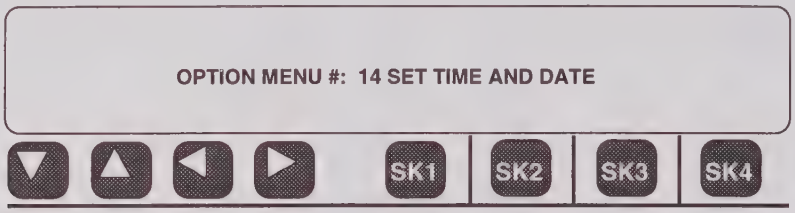
Press softkey 4 under **20-300 Hz** to change the filter bandwidth selection from 20-300 Hz to 4-300 Hz. Assume that the 930A displays the following measurements:

The fact that the readings are relatively the same as the example, suggests that the source of the excess jitter has a fundamental frequency above 20 Hz since there are no significant contributions to the levels from below 20 Hz.

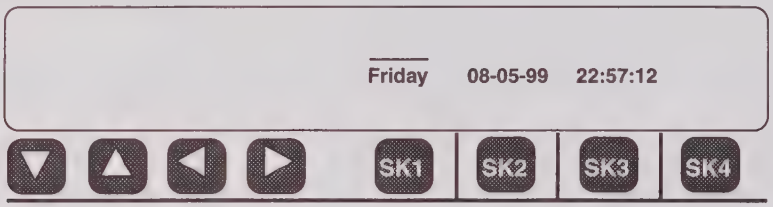
Between 20 Hz and 300 Hz the most significant source of jitter is the 60 Hz AC power line frequency and its 2nd through 5th harmonics (120 Hz, 180 Hz, 240 Hz, 300 Hz).

6-14 OPTION MENU #: 14 SET TIME AND DATE

Press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **14** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



Press any softkey under the display and the currently stored time and date will be displayed. The cursor always appears over the day of the week.



Use the Left/Right arrow keys to position the cursor over the day, date or time parameter. Use the Up/Down arrow keys to change the parameter under the cursor. From any position, use softkey 4 to return the cursor to the day of the week (located over softkey 1).

As an example, suppose it is desired to advance three hours to compensate for a time zone change from west coast to east coast time.

Use the Right arrow key to position the cursor over the **14** as shown below:

Use the Up arrow key to advance the hour to **17** as shown below:

For parameters other than the day of the week, you may enter a number directly using the numeric keypad. In this case, after selecting the first number, you will be taken to a display similar to the following:

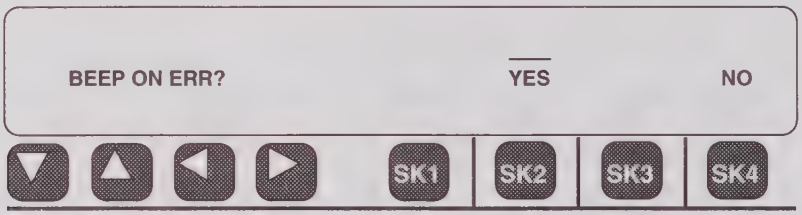
The cursor will flash over your selection. Complete this function by entering a second number or press **ENT** or any softkey. You will return to the main display. The cursor will automatically advance to the next field.

When the correct time and date have been set, press the **OPTION MENU** key to exit.

6-15 OPTION MENU #: 15 BEEP ON ERR?

This option provides you with an audible indication of various types of errors. This option provides the means to turn off the beep. Press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **15** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press any softkey to continue. You will see the following display:



If the cursor appears over the **YES** field, the beep has been turned on. To turn it off, press softkey 4 under **NO**. To turn the beep back on, return to this option menu and press softkey 2 under **YES**. If your 930A is equipped with *Purchased Option 930A-10C, Remote Control*, disabling the beep also prevents the 930A from sending the "Bell" character (ASCII 07) to a remote printer, terminal, or computer. See **Section 7, Remote Control Operation** for more information.

6-16 OPTION MENU #: 16 DIGIT RECEIVER TIMEOUT

This option allows the 930A to set a timeout for the digit receiver. If the timeout elapses while the digit receiver is expecting a digit, the 930A closes the digit record. This allows the digit receiver to be used more easily when an unknown number of DTMF or dial pulse digits are expected.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **16** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press any softkey to continue. You will see the following display:

The valid range is from **0.1** to **99999.9 SECS**. The **DEFAULT** is **10.0 SECS**. Press **EXIT** when complete. Select **OPTION MENU #: 4 DIGIT RECEIVER** to complete the procedure. See **Section 6-4, Option Menu #: 4 Digit Receiver** for more information on receiving digits.

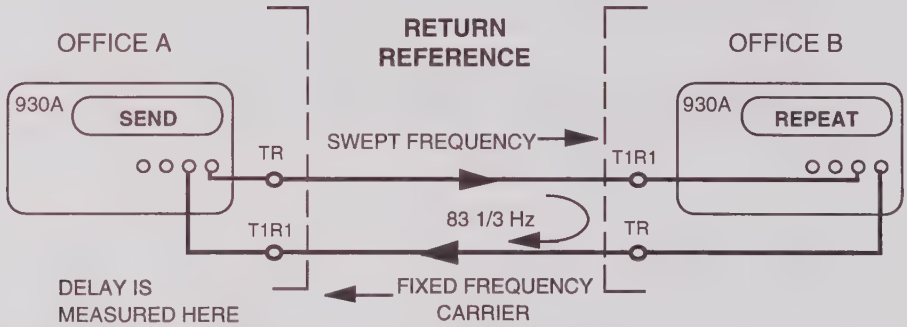
If you are using **OPEN** mode in the dry circuit Trunk Type, set the timeout to **99999.9 SECS**. For more information on dry circuits, see **Section 6-95, Option Menu #: 95 Dry Circuit**.

If you do not set the timeout to 99999.9 seconds, the 930A may not have adequate time to receive the digits. (After the first record is complete, it may take longer than 10 seconds to receive the digits for the second, third and consecutive records.) The 930A will not perform accurately. When in **OPTION MENU #: 4 DIGIT RECEIVER**, press softkey 3 under **HOLD** to release the 930A from this condition. Return to **OPTION MENU #:16 DIGIT RECEIVER TIMEOUT** to reset the timer to **99999.9 SECS** again.

6-17 OPTION MENU #: 17 ENVELOPE DELAY

Envelope Delay Distortion (EDD) is always an end-to-end test. It requires test sets at both ends of the circuit and a 4-wire transmission path. One end is set-up in the **REPEAT** (or Slave) mode. The other end is set-up in **SEND** (or Master) mode. The **SEND** unit transmits a single frequency (usually 1804 Hz) to establish a reference delay. This delay is "zeroed out," and the **SEND** unit sends a frequency sweep, measuring delay in microseconds relative to the reference. The **SEND** end then transmits the reference frequency while the **REPEAT** end sweeps the returned carrier. All delay measurements are made at the **SEND** end. These tests are commonly referred to as Return Reference and Forward Reference measurements.

The measurement proceeds as shown below:

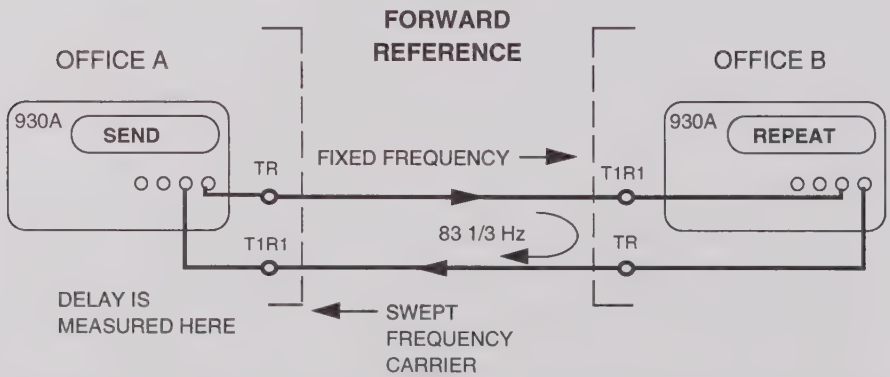


1) Office A sends an amplitude-modulated signal over the trunk under test.

2) Office B strips off the modulation and applies it to a carrier.

3) Office A recovers the returned modulation and compares it to that being sent. The difference in phase is proportional to the envelope delay.

4) The delay at a reference frequency is used as a zero reference, and a frequency sweep is then performed by the **SEND** unit. The delay at the other frequencies is measured in microseconds relative to the reference.



5) The **SEND** unit sends the reference frequency while the **REPEAT** unit sweeps the returned carrier. This allows the **SEND** unit to measure the delay on the return path.

6-17.1 Envelope Delay Distortion Parameters

Make sure that the 930A at each end of the circuit is set to the correct Trunk Type and impedance. Use the **Dial/ Ring** function key to place a call over the trunk under test. See **Section 3, Function Key Operation** for set-up information. With both units off-hook, a voice path is available through the front panel TelSet jacks. A handset can be connected to allow coordinating the test activities with the far-end if a separate voice path is not available. Decide at this point which unit will be the **SEND** end and which will be the **REPEAT** end.

Envelope Delay is specified for operation on any 4-wire Trunk Type that does not have DC supervision on Tip/Ring and Tip1/Ring1 connections. Operation in other Trunk Types, for example 4-wire Loop, will result in degraded accuracy.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **17** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Any of the test parameters may be changed or you may go directly to the measurement mode. If the test set-ups have been previously entered it is not necessary to re-enter the set-up mode. If this is the case, skip to **Section 6-17.6, Send Mode** to proceed with testing.

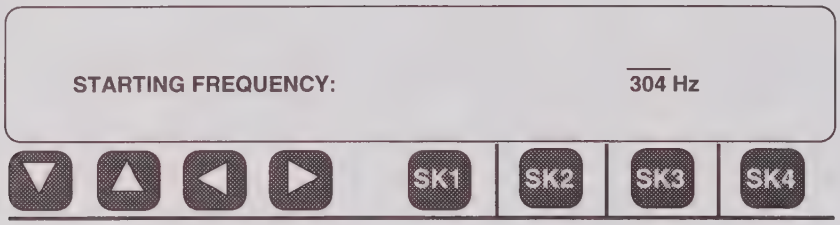
6-17.2 Set-up Mode

To enter the set-up menu, press softkey 1 under **SET-UP** and the display will change to:

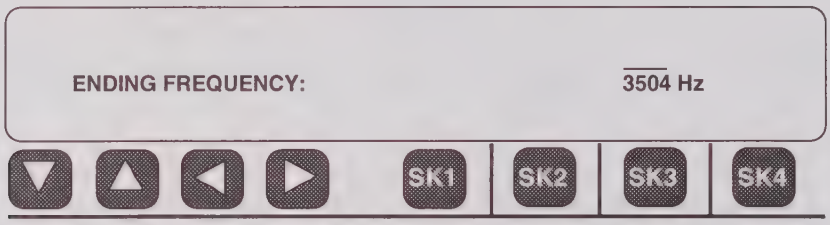
The 930A default parameters have been preset to sweep from **304 Hz** to **3504 Hz** in **100 Hz** steps at a level of **-16 dBm** and a time between steps of **3.5** seconds with the SF frequency (2600 Hz) skipped. You do not need to enter the **SET-UP** menu unless you want to change these settings. If this is the case, skip to **Section 6-17.6, Send Mode** to proceed with testing.

6-17.3 Bounds

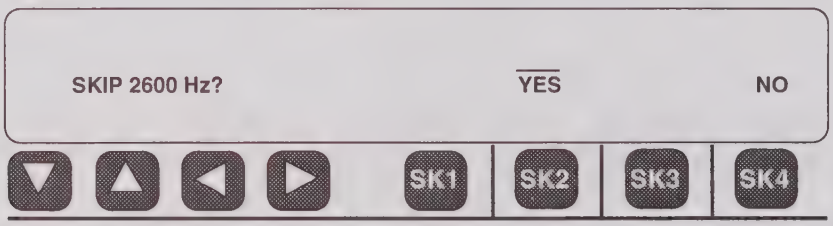
To change the starting or ending frequency parameters, press softkey 1 under **BOUNDS.** You will see the following display:



The cursor will be flashing over the current value. Enter a number between 304 and 3504 Hz using the numeric keypad. Press any softkey or **ENT**. The display will advance to:



Enter a value using the numeric keypad and press any softkey or the **ENT** key. The 930A will advance to:



To skip SF (2600 Hz), press softkey 2 under **YES**. If you do not want to skip SF, press softkey 4 under **NO**. The 930A will return to the last **SELECT** display.

> *If your starting frequency is greater than your ending frequency, the frequency will increment according to the **STEP** and **TIME/LEVEL** you've indicated until it reaches 3500 and will then stop.*

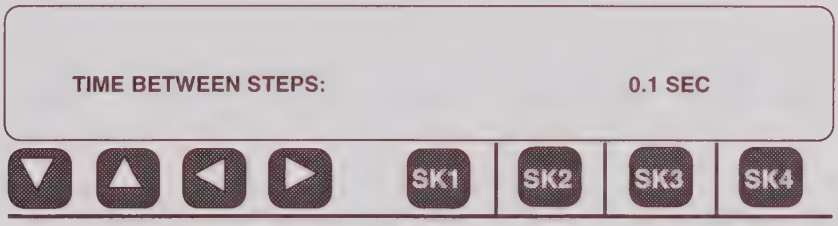
6-17.4 Step

To change the step size, press softkey 2 under **STEP**:

Enter a new value between **1** and **999 Hz** via the numeric keypad. Press any softkey or **ENT** to return to the **SELECT** menu.

6-17.5 Time/Level

To change the step size, press softkey 3 under **TIME/LEVEL**:



The **TIME** between steps can be changed to any value between **0.1** and **9.9 SEC**. The display will advance to the **LEVEL** screen. The level may be changed from **-16.0 dBm** to any value between **-40** and **+12 dBm**. Since this menu is taken directly from **OPTION MENU # 10: FREQUENCY SWEEP**, levels may be entered from +12.0 dBm to -60.0 dBm and they will appear to be accepted. However, the 930A will only transmit over the 0 dBm to -40.0 dBm range allowed in Envelope Delay Distortion measurements. Press softkey 4 under **EXIT** when the sweep parameters have been set to the desired specifications. This returns the 930A to the main EDD selection display. Once the 930A has been set-up, it is not necessary to enter the set-up menu to start testing.

> *One test set must be in the **SEND**, or Master mode while the set at the other end must be in the **REPEAT**, or Slave mode.*

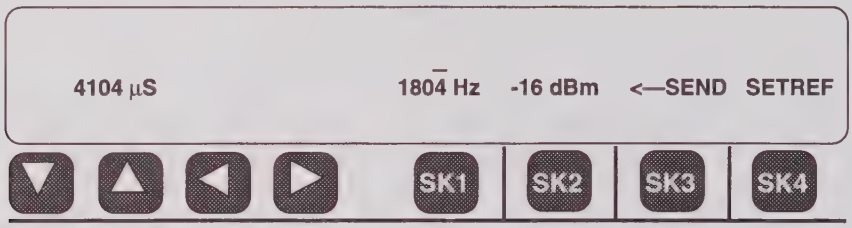
The following sections explain the operation of the 930A when performing EDD measurements.

6-17.6 Send Mode

Starting from the main EDD selection display shown above, press softkey 2 under **SEND.**

6-17.6.1 Example: Send Mode

A display similar to the following will appear:

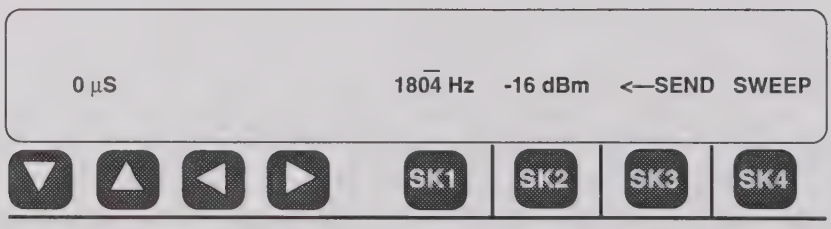


This display shows the calculated phase delay in microseconds for the return reference signal from the **REPEAT**, or Slave unit, and the level and frequency of the signal being sent from the **SEND**, or Master unit. All measurements of EDD are made at the **SEND** end of the circuit. EDD is also a referenced measurement.

Notice a cursor over the last digit in the reference frequency displayed (the number **4** in the above example). To change the frequency, enter the new number from the numeric keypad and press **ENT** or any softkey. The valid frequencies are between **304 Hz** and **3504 Hz.**

Press softkey 2 under the level. The cursor will move to the last digit of the level. Enter the new level using the keypad. Press **ENT** or any softkey. The valid levels are between **0 dBm** and **-40 dBm.**

Allow the reading (at the far left of the display) to stabilize before setting the reference delay; wait approximately 15-20 seconds. Press softkey 4 under **SETREF** or the **CLR** key. The current envelope delay reading will become the reference and all subsequent measurements will be relative to this reference. This effectively "zeros out" the current measurement. Once a reference has been established, the frequency or level of the outgoing reference signal can be changed or the frequency sweep can be generated. You will hear a high pitch tone. The display should resemble the screen shown below:



Notice the **SETREF** display has changed to **SWEEP**. To send a sweep and perform a Return Reference measurement after setting the reference delay, press softkey 4 under **SWEEP**.

The sweep parameters (which were set-up earlier) will automatically begin. The delay will be measured and displayed for each frequency in the sweep. If a terminal or 80 column printer is attached, and the 930A is in **PRINTER** Remote Mode (requires *Purchased Option 930A-10C, Remote Control Interface*, the 930A will automatically print the delay at each frequency of the sweep. See **Section 6-3, Option Menu #: 3 Remote Control** or **Section 7, Remote Control Operation** for further instructions. To interrupt the sweep, without leaving the **SEND** mode, press softkey 4 under **STOP?** as shown in the display below:

When the sweep completes or is interrupted, the 930A will revert to sending the reference frequency. Softkey 4 will again be labeled **SWEEP** as shown below:

The sweep can be repeated or the frequency of the signal can be manually set to examine the delay at frequencies of interest. To exit this display, press the **Option Menu** key.

To examine the level and frequency of the returned carrier, press softkey 3 under **<-SEND**. The received level and frequency will be displayed and the label above softkey 3 will change to read **<-RECV**. Toggle between viewing the outgoing signal and the returned carrier at any time. An example display of the returned reference carrier while sweeping from the Send unit is shown below:

The carrier level should be within the 0 dBm to -40 dBm range and steady for the test to be valid.

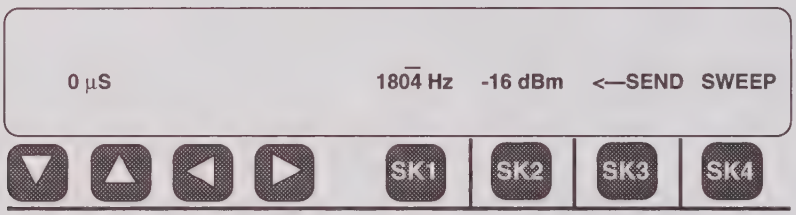
When all of the measurements are complete, the operator at the near-end, (Send end) can alert the operator at the far-end to sweep the return carrier. This will allow a Forward Reference measurement to be made of the return path delay. The Send unit transmits the fixed reference signal toward the Repeat unit, (Slave unit) at the far-end.

6-17.7 Repeat Mode

Once the near-end 930A has been set-up for the **SEND** mode, the 930A at the other end of the circuit must be set to the **REPEAT** mode.

6-17.7.1 Example: Repeat Mode

To place a 930A in **REPEAT** mode, (Slave mode) press softkey 3 under **REPEAT** from the main **SELECT** menu. You will hear a high pitch tone and see the following display:



This display shows the level and frequency of the carrier tone that is being used to return the amplitude modulation to the Send unit. The default value is **1804 Hz** at **-16 dBm**.

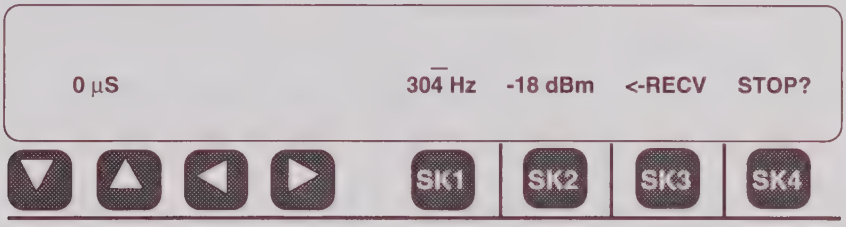
Notice a cursor over the last digit in the reference frequency displayed (the number **4** in the above example). To change the frequency, enter the new number from the numeric keypad. Press **ENT** or any softkey. The valid frequencies are between **304 Hz** and **3504 Hz**.

To change the level, press softkey 2. The cursor will move to the last digit of the level. Enter the new level using the keypad. Press **ENT** or any softkey. The valid levels are between **0 dBm** and **-40 dBm**.

To examine the level and frequency of the signal being received, press softkey 3 under **<-SEND** and the display will change to show:

This display shows the level and frequency of the signal being sent to the Repeat unit from the Send unit. When the sweep completes, the Return Reference part of the measurement is over. It is then followed by the Repeat unit sweeping for the Forward Reference test. Press softkey 3 to toggle between the received signal and the returned carrier.

To sweep the returned carrier for a Forward Reference measurement, press softkey 4 under **SWEEP** and the 930A display will change to:



The 930A will begin to sweep the returned carrier through the frequencies that were selected previously. To interrupt the sweep without leaving the Repeat mode, press softkey 4 under **STOP?**. When the sweep completes or is interrupted, the 930A will revert to sending the reference frequency. Softkey 4 will once again be labeled **SWEEP**.

To exit this display, press the **Option Menu** key. Press the **Option Menu** key again or softkey 4 under **EXIT** to take you to the main display.

6-18 OPTION MENU #: 18 PEAK TO AVERAGE RATIO (P/AR)

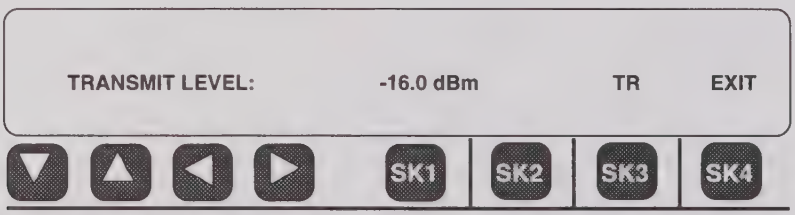
With *Purchased Option 930A-06, P/AR* installed in your 930A, you can measure P/AR values over a 0 to 120 P/AR unit range.

Connect the 930A to the circuit under test at the 2- or 4-wire analog trunk access point or at the DEMARC. It can also be used on a T1 PCM Trunk at the DSX with *Purchased Option 930A-08E, Single Direction ESF* or *-09E, Dual Drop/Insert w/ESF*. Before making a P/AR test, set the 930A Trunk Type to the correct settings. See **Section 4, Analog Operation** or **Section 5, PCM Operation** for set-up information.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #:**. Press the Up/Down arrow keys to scroll through the option menus, or select **18** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Softkey 2 under **SEND** controls the set-up of the P/AR transmitter level and also sends the P/AR signal on 2- and 4-wire circuits. The set-ups are retained in non-volatile memory and need not be accessed every time a measurement is made, unless the level is to be changed.

Pressing softkey 2 **SEND** displays the P/AR transmit level display. As an example, the 4-wire E&M trunk is shown below:



The test set at the far end of the circuit would receive and display the P/AR measurement. The valid transmit level range in analog Trunk Types is between **-60.0 dBm** and **0 dBm**. The valid transmit level range in analog Trunk Types is between **-60.0 dBm** and **-13.0 dBm**. Select the desired level using the numeric keypad and press **ENT**. Pressing softkey 4 under **EXIT** in the above display returns the 930A to the main P/AR display.

Once the P/AR transmitter has been turned on and the level has been set, send and receive the P/AR waveform on a 4-wire circuit, or receive P/AR on a 2-wire circuit by pressing softkey 3 under **MEASURE**. A P/AR measurement display is shown below:

It is important to note that P/AR measurements are end-to-end measurements. On 2-wire circuits, one end transmits while the other receives, then the sender and receiver switch places. One of the test sets must have its transmitter turned off and act as a receiver only. To accomplish this press softkey 3 under **MEASURE** immediately after entering Option Menu #: 18. Do not press softkey 2 under **SEND**. This keeps the P/AR transmitter turned off.

On 4-wire circuits, simultaneous transmitting and receiving is possible. When entering **OPTION MENU #: 18 P/AR MEASUREMENT** press softkey 2 under **SEND** first. After checking or adjusting the transmit level, press softkey 4 to **EXIT** and then press softkey 3 under **MEASURE**. This mode does not disable the transmitter. The 930A can transmit and receive at the same time.

Press softkey 4 to exit this option.

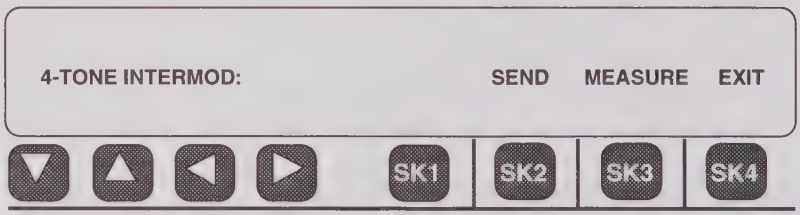
6-19 OPTION MENU #: 19 4-TONE INTERMODULATION DISTORTION

Intermodulation Distortion (IMD) measures the 2nd and 3rd order distortion products created in a non-linear circuit in the presence of a 4-tone signal.

IMD, sometimes referred to as Non-Linear Distortion or 4-Tone Intermod, is an end-to-end measurement. That is, one test set sends the tone pairs at 857 Hz, 863 Hz and 1372 Hz, 1388 Hz while the other set has its receiver looking at a band of frequencies centered around 520 Hz, 2240 Hz and 1900 Hz. The energy received in these filters constitutes the energy in the 2nd and 3rd order IMD products. On 4-wire circuits, a loopback can be inserted at the distant end so that one set may send and receive. On a 2-wire circuit, two sets are required, with one set either sending, or receiving, in turn.

Before testing, you must be in the appropriate Trunk Type. See **Section 4, Analog Operation** and **Section 5, PCM Operation** for set-up information.

Connect the 930A to the circuit. After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **`OPTION MENU #:`**. Press the Up/Down arrow keys to scroll through the option menus, or select **`19`** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



Press softkey 2 under **`SEND`** to transmit and/or adjust the IMD tones being sent, to select the signal-to-noise test tones, or to send the Intermod tones over a 2-wire circuit. The display will show:

The cursor appears over the last test selected. To send the signal-to-noise test tones, press softkey 1 under **`S/N TEST`**. This will suppress one tone pair while amplifying the other pair to maintain the same average level. This measurement is usually performed before IMD testing; the 930A uses the S/N value to automatically correct the IMD measurement results.

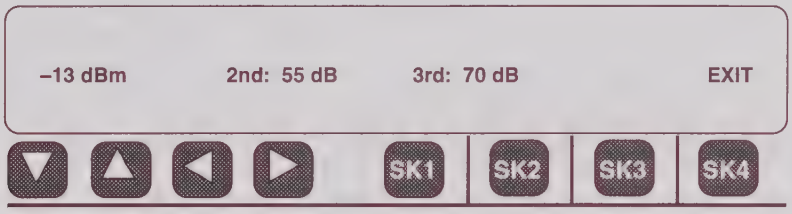
Press softkey 2 under **4-TONE** to send the four intermodulation distortion test tones at the level displayed. On a 2-wire circuit, another 930A or a test set with Intermod Distortion measuring capability must be at the distant end.

If a transmit level other than the default value of -13 dBm is desired, simply enter the new value using the numeric keypad. Press the **ENT** key after the new level has been keyed in.

For analog Trunk Types, the valid range for the send levels are **-40 dBm** to **0 dBm.**
For PCM Trunk Types, the valid range for the send levels are **-40 dBm** to **-6 dBm.**

Press softkey 4 to **EXIT** to the main IMD menu. This will not interrupt the tones being sent. From the main menu, the test can be terminated, or the **MEASURE** mode can be selected to test on a 4-wire looped-back circuit.

Pressing the **Option Menu** function key or softkey 4 under **EXIT** again will terminate testing. Press softkey 3 under **MEASURE** to measures the IMD present on the trunk under test. A typical display is shown below:



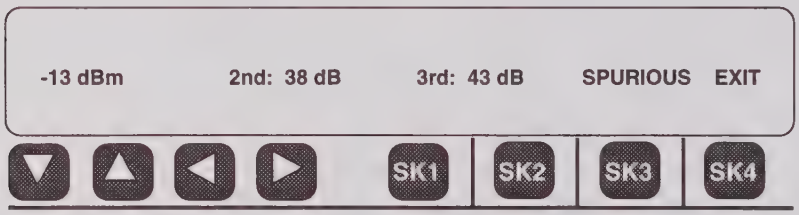
The first field in the above example is labeled **-13 dBm**. This field shows the composite received level of the four IMD tones. If no signal is present this field will be blank. The second field is labeled **2nd: 55 dB** and is the level at which the 2nd order intermodulation (IM) products are being received below the level of the four IMD tones. In this example, the 2nd order products are 55 dB below the IMD tone level of -13 dBm for a total of -68 dBm. Similarly, the third field is labeled **3rd: 70 dB** and is the level at which the 3rd order IM products are being received below the -13 dBm signal level.

Messages appear above softkey 3 indicating conditions of the measured signal:

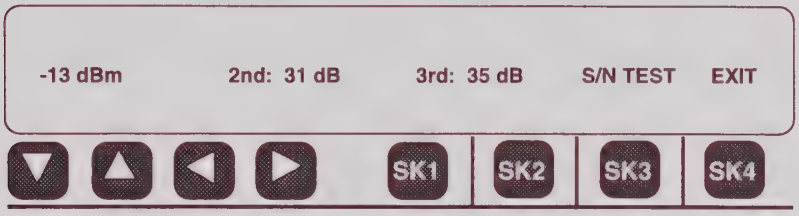
1. The message **INVALID** indicates an invalid signal; i.e., the IMD signal is absent, the level is below -40 dBm, or too high for the circuit (>0 dBm in analog, >-6 dBm in PCM). A typical display is shown below:

2. The message **TWIST** indicates that the IMD tones are being received at unequal levels (i.e., they differ by more than 6 dB from each other). A sample display is:

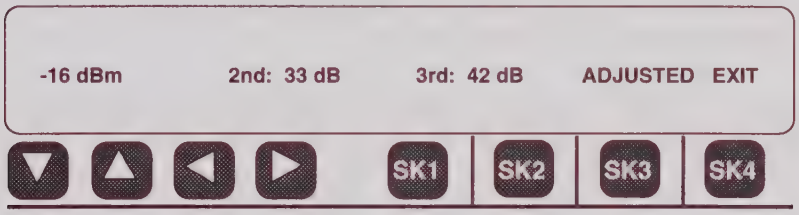
3. The message **SPURIOUS** indicates the presence of a spurious tone (any tone other than the four test tones). A typical display follows:



4. The message **S/N TEST** shows that the 930A is receiving the signal-to-noise test tones. The **2nd** and **3rd** fields contain noise measurements where the distortion products used to be. The measurements are in dB below the received signal as a S/N ratio. The display will appear as:

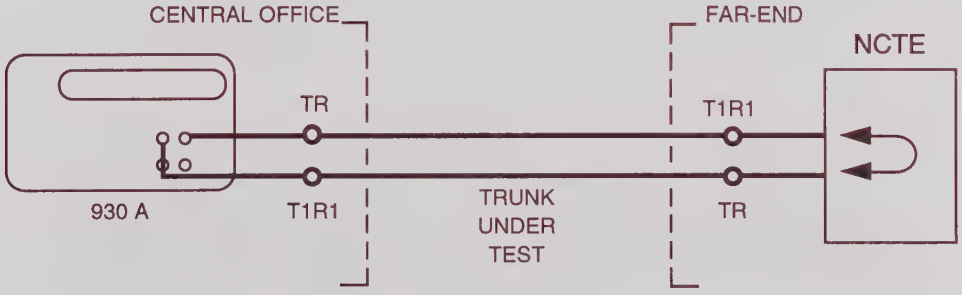


5. The message **ADJUSTED** indicates that the distortion measurements are being corrected automatically for signal-to-noise ratio. A typical display is:



6-19.1 Example: 4-Tone IMD Test on a 4-Wire Circuit

The trunk to be tested is a 4-wire circuit. A Network Channel Terminating Equipment (NCTE) is at the far-end which is capable of providing a loopback on the line. A typical circuit diagram is shown below:



To make a corrected measurement of IMD:

1. Select the correct Trunk Type on the 930A and connect the test cords.

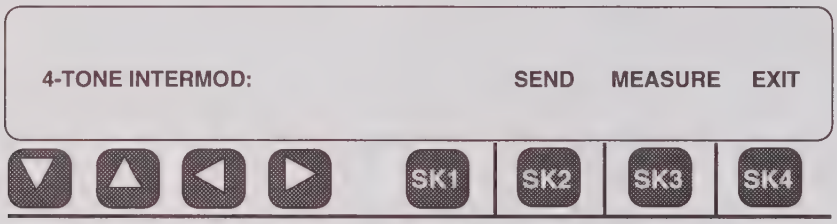
2. If the trunk under test is a dedicated line, and not a dial-up line, proceed to step 3. If not, press the **Dial Ring** function key, put the hookswitch in the **Off Hook** position and dial the far-end loopback device's number. See **Section 3, Function Key Operation** for set-up information.

3. Press the **Send Tone** function key and set the 930A to send 2713 Hz at -10 dBm for 5 seconds to loop the device at the far-end. See **Section 3, Function Key Operation** for set-up information.

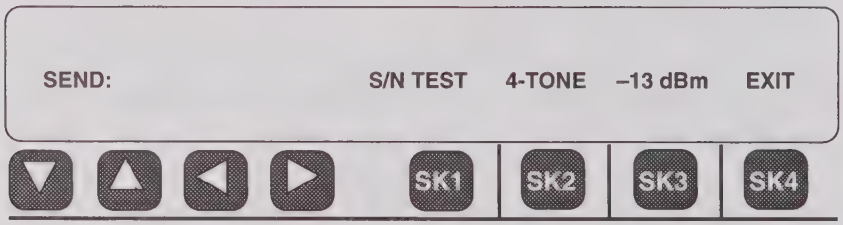
4. Press the **Measure Tone** function key. When the line is looped, the 2713 Hz tone will be displayed and the tone will be audible. See **Section 3, Function Key Operation** for set-up information.

5. Press the **Send Tone** function key again and press softkey 4 to turn off the 2713 Hz tone.

6. Press the **Option Menu** function key, select **19** and press the **ENT** key to see:

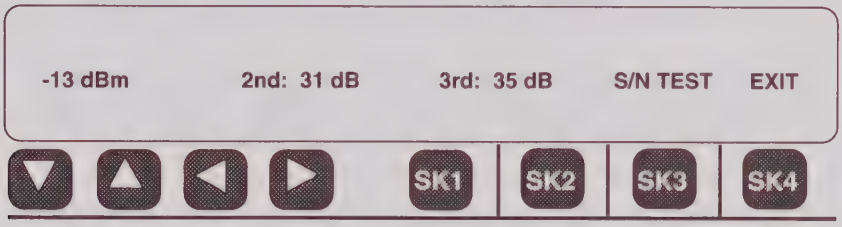


7. Press softkey 2 under **SEND**. The 930A display will change to:

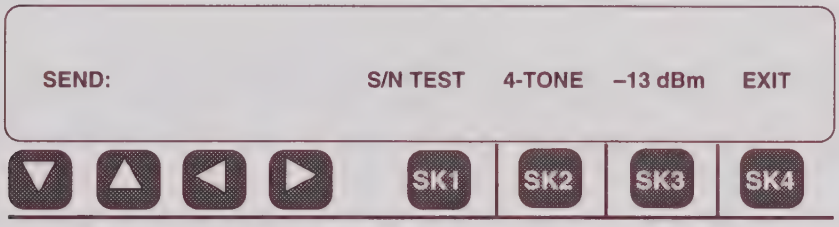


8. Press softkey 1 under **S/N TEST** and set the level to -13 dBm if it is not at that level. Press softkey 4 to **EXIT** to the main menu. The 930A sends the Signal-to-Noise test tones.

9. Press softkey 3 to select **MEASURE**. Wait a few seconds for the measurements to stabilize. The received level and the **2nd** and **3rd** fields will contain test results. A typical display will be:

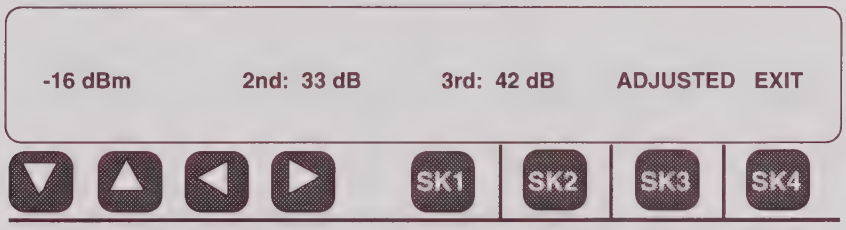


10. Press softkey 4 to exit back to the main menu. Press softkey 2 to select **SEND**.



11. Press softkey 2 under **4-TONE** and the 930A sends the IMD test tones at -13 dBm. Press softkey 4 to exit back to the main menu. Press softkey 3 under **MEASURE**. Wait for the measurement to stabilize. The word **ADJUSTED** should appear to the left of the word **EXIT**.

An example of a corrected IMD products display is shown below:



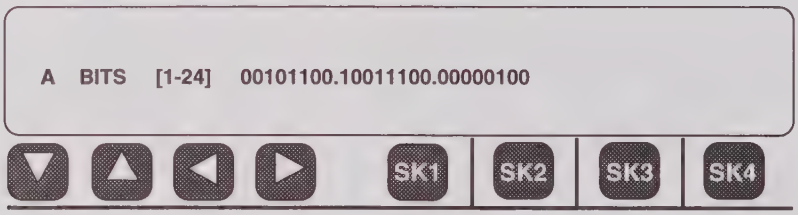
Before going back on-hook, press the **Send Tone** key and send the 2713 Hz tone again to release the loopback. When this has been accomplished, put the hookswitch in the **On Hook** position or press softkey 4 under **EXIT** to terminate testing.

6-20 OPTION MENU #: 20 24 BIT DISPLAY

When you are working on a T1 span, this option allows you to see the state of the A and B bits (and the C and D bits on ESF) on all 24 channels simultaneously. With the 930A, these bits at the DSX monitor jacks may be checked. You can check them in one direction if your 930A is equipped with *Purchased Option 930A-08E, Single Direction ESF* or in both directions with *Purchased Option 930A-09E, Dual Drop/Insert w/ESF.*

To look at the supervision states, all you have to do is connect your 930A to the DSX. Make sure the 930A is set to the PCM Trunk Type and that default settings are correct. If it is set to the **MON-1** mode, you will be able to look at the supervision bits on one side at a time. If you are in the **MON-1&2** mode, you can switch from **RECV-1** to **RECV-2**, and look at the supervision bits in both directions.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **20** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



The channels are numbered from 1 to 24, left to right. The bits have two states, 0 and 1. Usually a 0 indicates on-hook and a 1 indicates off-hook or busy. On a working span, you will see calls completing and terminating, so the display will be changing constantly as calls come and go. Pressing any softkey or arrow key will page you through the B bit display. On an Extended Superframe span, the C and D bits will also display.

If you are in Printer Remote mode, the 930A will print a copy of its display whenever a bit changes. In Computer Remote mode, it will send a Bell (ASCII 07) to the computer. See **Section 7, Remote Control Operation** for more information.

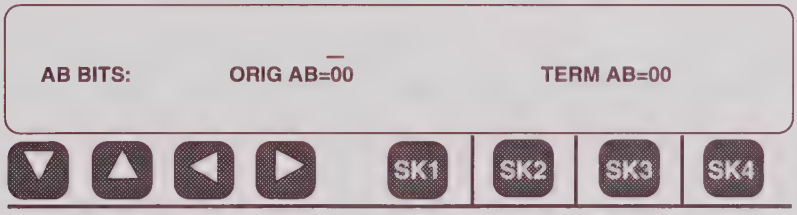
Press the **Option Menu** function key to leave this menu.

6-21 OPTION MENU #: 21 TOGGLE A/B BITS

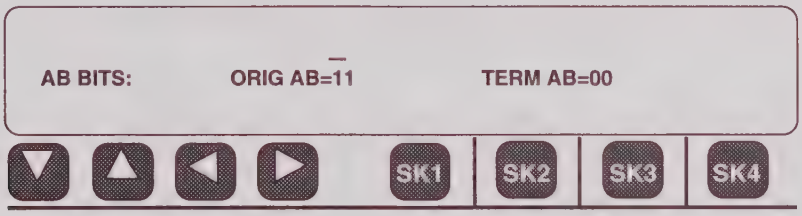
Normally, the front panel hookswitch would be used for going on- and off-hook. The 930A also provides you with **OPTION MENU # 21** which gives you complete control over the A/B/C/D bit states. This option also lets you view the A/B/C/D bit status on the selected channel in both directions when you are in the **MON-1&2** mode. You can set the states of your supervision bits manually from this option.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **21** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. Depending upon whether you are on a D4 Superframe, SLC-96 or Extended Superframe T1 span, the display will be:

For normal **D4/SF** (Superframe):



For normal **SLC-96**:



For **ESF** (Extended Superframe):

In all of these examples, the originating end is on-hook.

If the 930A is in **MON1** mode, blanks will be displayed for the **ORIG** side.

To change the state of the A bit to a 1 or a 0, press 1 or 0 on the keypad and the A bit will be changed. The cursor will then move over the next digit.

The **TERM** bits come from the **PCM IN** jack in the **RECV** direction. In **TERMINATE** or **MON-1** modes, the **ORIG** bits come from the 930A. In **MON-1&2** or **D&I** modes, the **ORIG** bits come from the other direction. In all cases, **TERM** is the **RECV** bit stream.

Press the **Option Menu** function key to exit this option.

6-22 OPTION MENU #: 22 ABSOLUTE DELAY

Absolute Delay provides a Round Trip delay measurement in milliseconds of the total delay for a given circuit. Some specifications for Absolute Delay as compared to Envelope Delay are the following:

1. This option is available in 4W Trunks only.
2. Forward frequency for Absolute Delay will be 1020 Hz.
3. Return frequency for both is 1804 Hz.
4. The Modulation frequency for both is 83.333 Hz.
5. The level of the signal is measured for Absolute Delay.
6. Absolute Delay may require a Echo Canceller Disable tone of 2100 Hz.
7. The Absolute Delay measurements are to 1 millisecond resolution.

6-22.1 Set-up

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **22** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

If in a 2W Trunk Type, the 930A will display **– 4-WIRE ONLY!! –**. Exit this option and enter the Trunk Type function key. Change from **2W** to **4W** using softkey 4. See **Section 3, Analog Operation** and **Section 4, PCM Operation** for set-up information.

If in a 4W Trunk Type, you will see:

The initial measurement is normally in microseconds and is considered preliminary. If the Echo Canceller must be disabled, press softkey 3 under **ECHO** to send the 2100 Hz disabling tone.

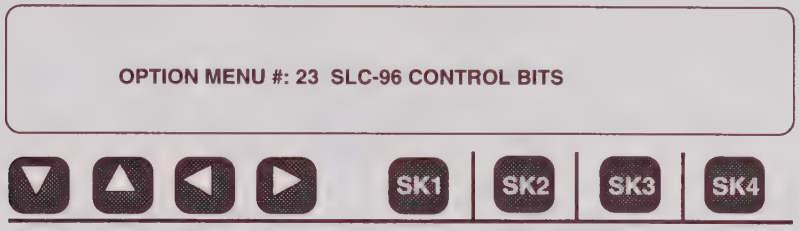
The following screen is momentarily displayed:

Press softkey 4 under **START**. Wait for the measurement to settle. The milliseconds measurement will flash for a few seconds. If the connections are incorrect or there is an absence of signal, the reading will be **NO TONE!** Otherwise there will be a reading in milliseconds. Record the reading.

Press softkey 4 under **RESTART**. Again, wait for the measurement to settle and record the second reading. The second reading is typically the most accurate measurement. Make a few additional measurements to verify that these measurements continue to be the same. This test is now complete. If a measurement of the one-way signal is required, press softkey 2 under **<–SEND** and the display will change to **<–RECV**:

The first measurement is in microseconds as before. Press **RESTART** to make the first Absolute Delay measurement. Take a second measurement as above. Record the second reading as the true measurement.

6-23 OPTION MENU #: 23 SLC-96 CONTROL BITS



This option allows the 930A to send or receive the various customer states for the four major Channel Unit types in SLC-96, including Single Party, Coin, Universal Voice Grade, and DID.

The 930A must be in **PCM, SLC-96** mode. Refer to **Section 3, Function Key Operation** and **Section 5, PCM Operation** for set-up information. After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **23** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If the 930A is not in SLC-96 mode, the display will read **MUST BE IN PCM WITH SLC-96 FRAMING.** Otherwise, you will see the displays on the following pages.

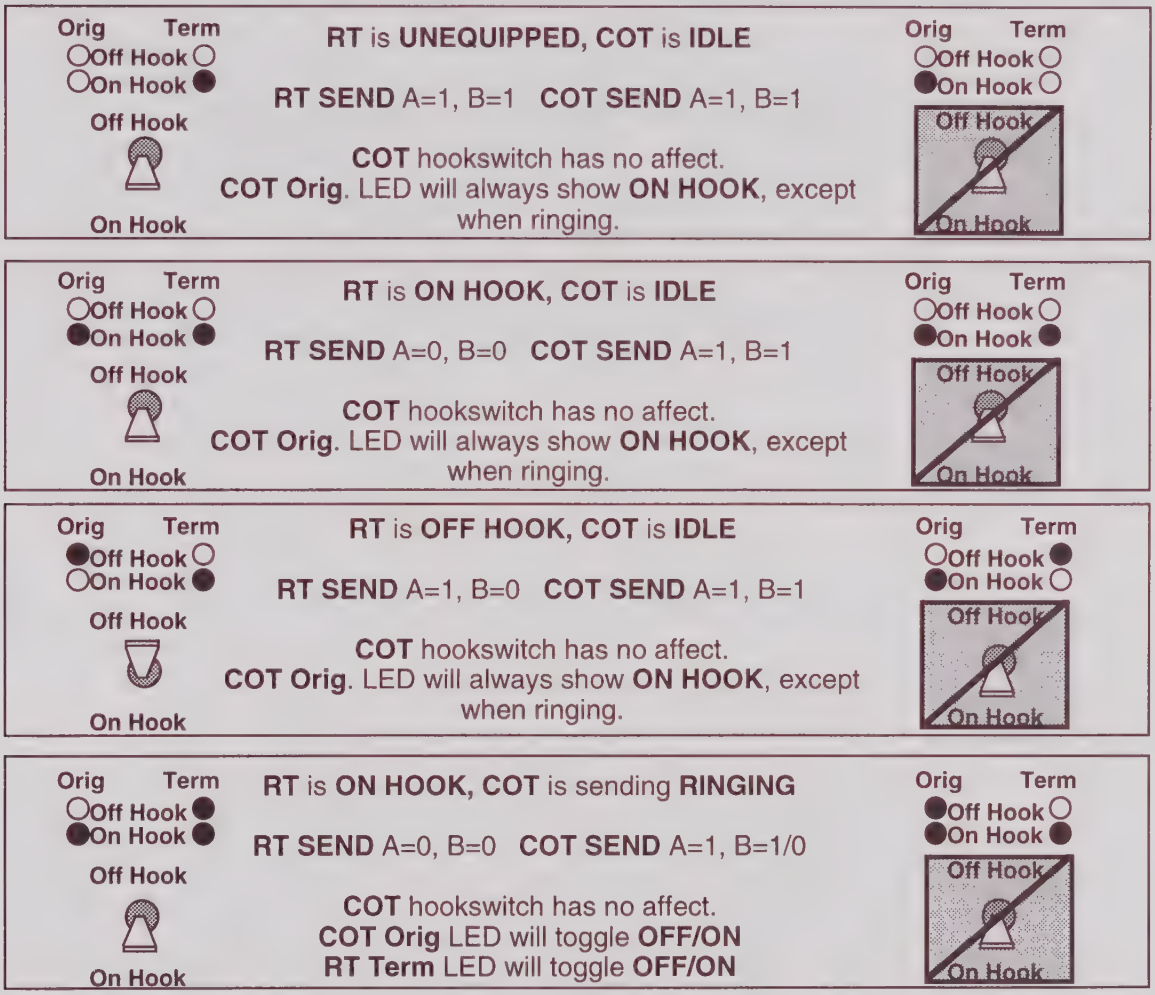
6-23.1 Central Office Terminal (COT), Single Party Mode

If in **COT, SINGLE** party mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **CHANNEL TEST, IDLE, FWD DISCONNECT,** or **-R RINGING.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. For information on Remote Terminal (RT) mode, see **Section 6-23.5**.

6-23.1.1 Detailed Description of Single Party Supervision Bits

Single Party Supervision



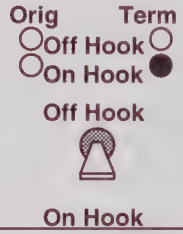
6-23.2 Central Office Terminal (COT), Coin Mode

If in **COT, COIN** mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **POS (positive) LOOP MODE, GROUND START, POS COIN CHK, -R RINGING, POS COIN CTRL, NEG COIN CTRL, NEG COIN CHK, NEG LOOP MODE,** or **CHANNEL TEST.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. For information on Remote Terminal (RT) mode, see **Section 6-23.5**.

6-23.2.1 Detailed Description of Coin Phone Supervision Bits

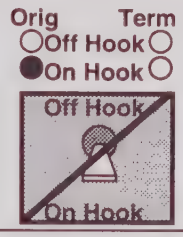
Coin Phone Supervision



RT is **UNEQUIPPED, COT** is **IDLE**

RT SEND A=1, B=1 **COT SEND** A=1, B=0

COT is sending **POSITIVE LOOP MODE** for idle.
COT hookswitch has no affect.



RT is **ON HOOK, COT** is **IDLE**

RT SEND A=0, B=0 **COT SEND** A=1, B=0

COT is sending **POSITIVE LOOP MODE** for idle.
COT hookswitch has no affect.

RT is **OFF HOOK, COT** is **IDLE**

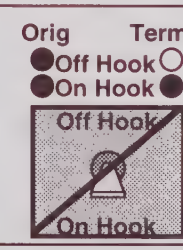
RT SEND A=1, B=0 **COT SEND** A=1, B=0

COT hookswitch has no affect.
COT Orig. LED will always show **ON HOOK**, except when ringing.

RT is **ON HOOK, COT** is sending **RINGING**

RT SEND A=0, B=0 **COT SEND** A=1, B=1/0

COT hookswitch has no affect.
COT Orig LED will toggle **OFF/ON**
RT Term LED will toggle **OFF/ON**



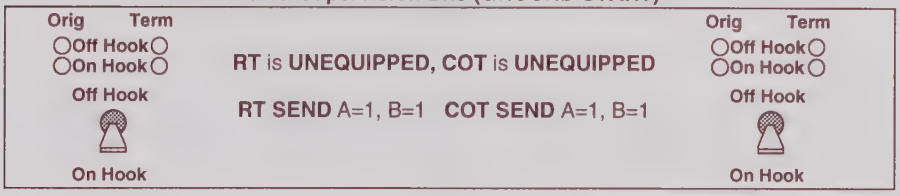
6-23.3 Central Office Terminal (COT), UVG, Ground Start Mode

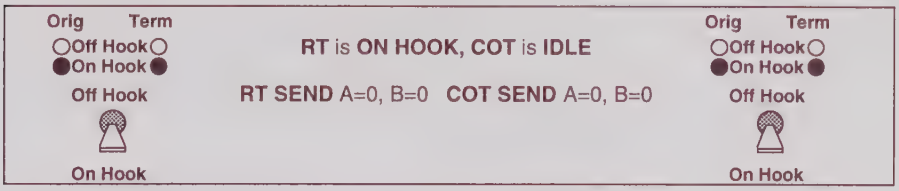
If in **COT, UVG** (Universal Voice Grade), Ground Start mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **–R RINGING, IDLE, GROUND START,** or **CHANNEL TEST.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. If the 930A is on-hook, the far right of the display will indicate an **ON HOOK** state. For information on Remote Terminal (RT) mode, see **Section 6-23.5**.

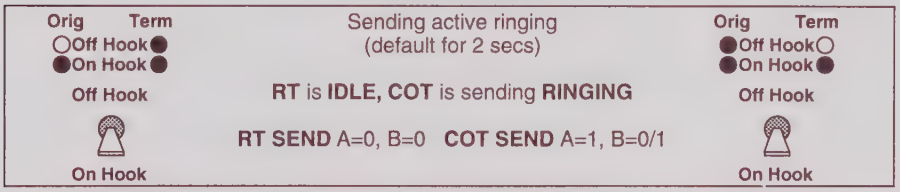
6-23.3.1 Detailed Description of UVG, Ground Start Supervision Bits

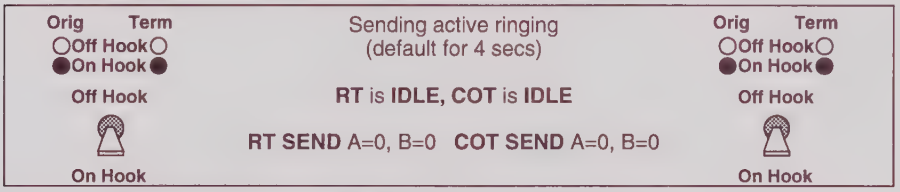
UVG Supervision Bits (GROUND START)

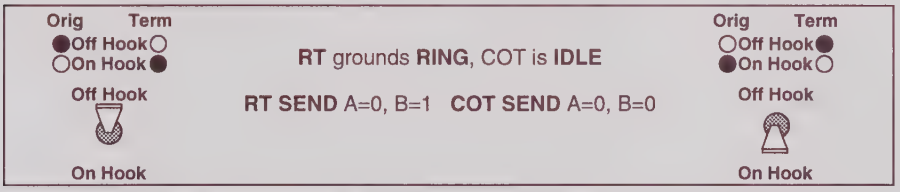


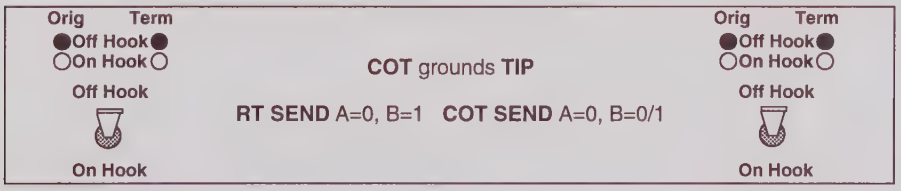


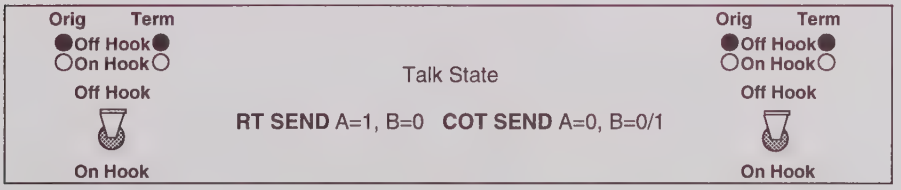
Ringing Sequence











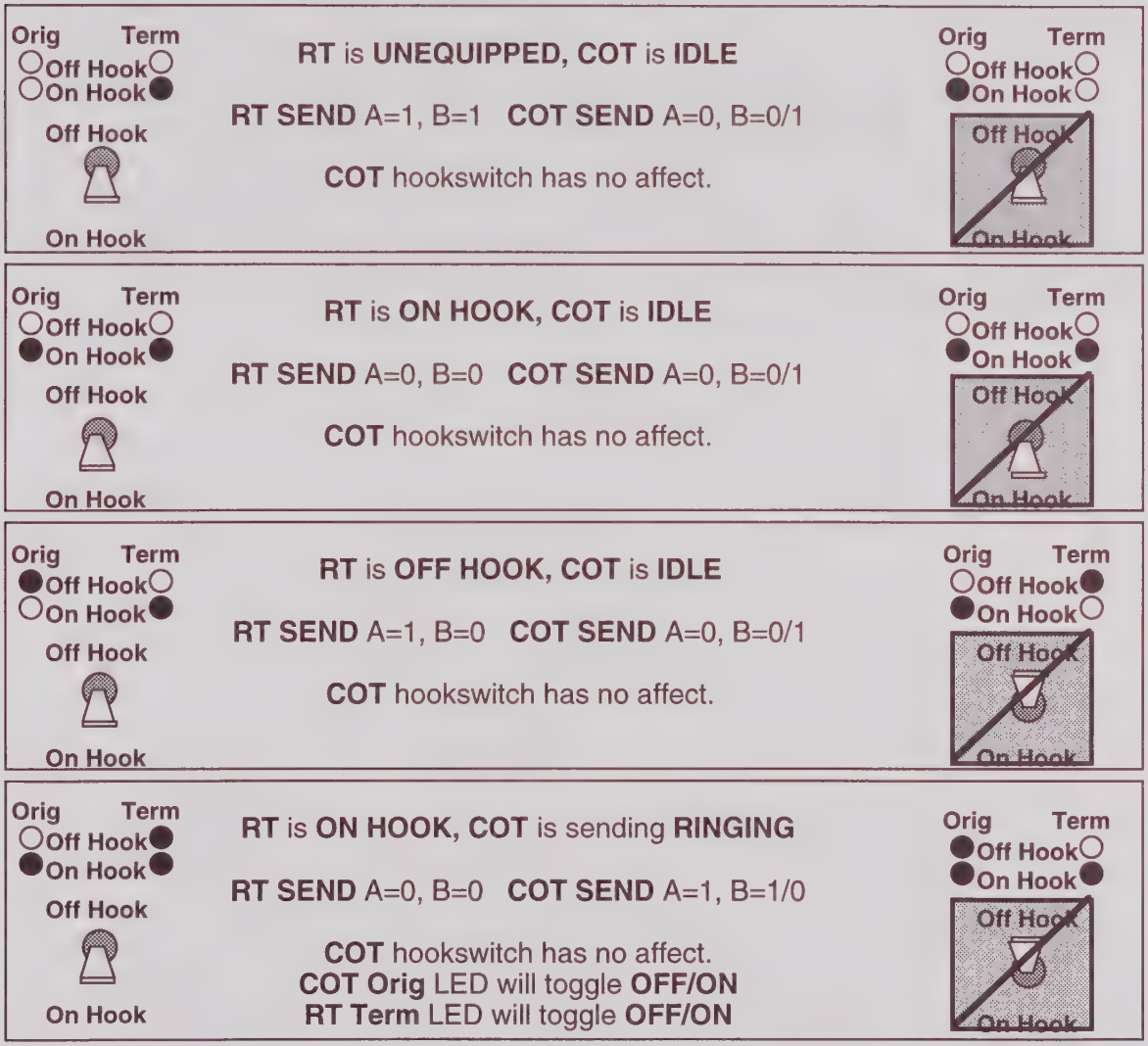
6-23.4 Central Office Terminal (COT), UVG, Loop Start Mode

If in **COT, UVG, LOOP START** mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **–R RINGING, IDLE, GROUND START,** or **CHANNEL TEST.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Remote Terminal (RT) mode, see **Section 6-23.5**.

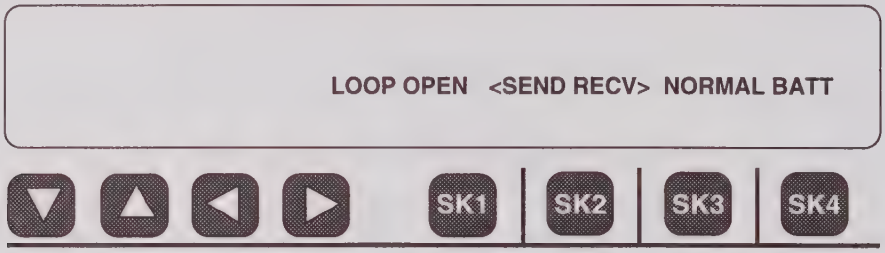
6-23.4.1 Detailed Description of UVG, Loop Start Supervision Bits

UVG Supervision Bits (LOOP START)



6-23.5 Central Office Terminal (COT), DID Mode

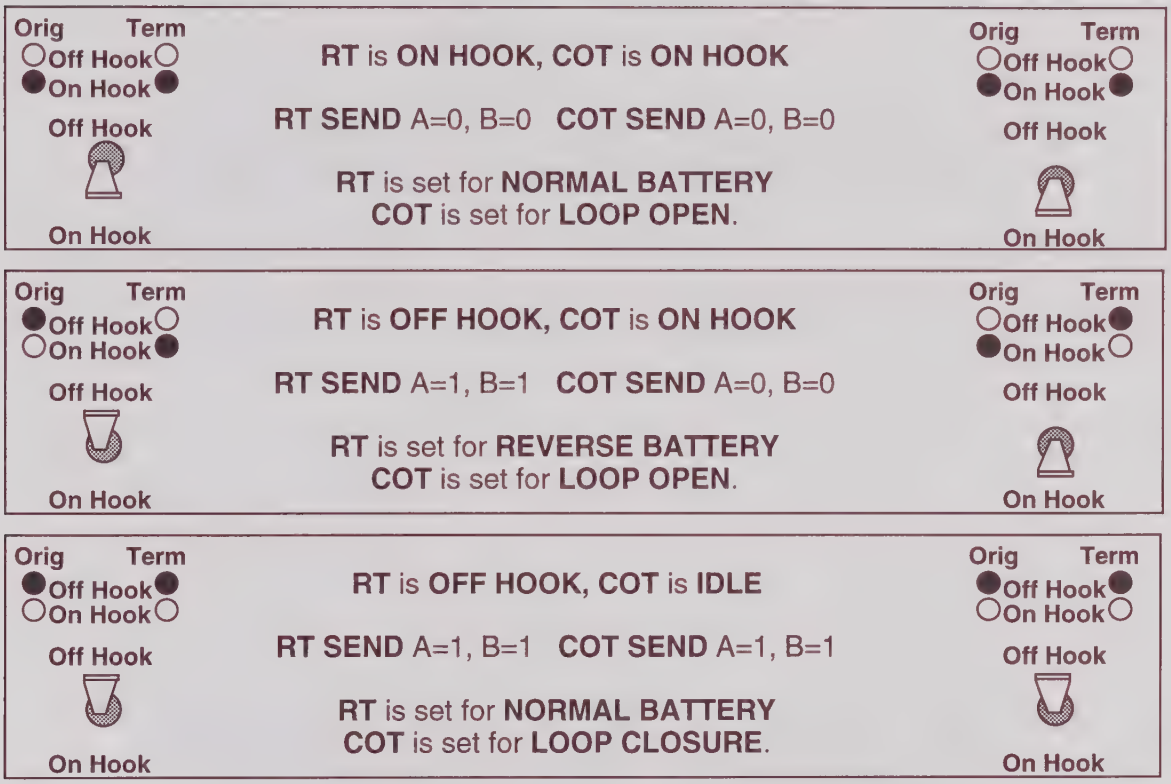
If in **COT, DID** (Direct Inward Dial) mode, the display shows:



Press the Up/Down arrow keys to scroll through the 2 available customer states: **LOOP OPEN** or **LOOP CLOSURE.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Remote Terminal (RT) mode, see **Section 6-23.5**.

6-23.5.1 Detailed Description of DID Supervision Bits

DID Supervision Bits



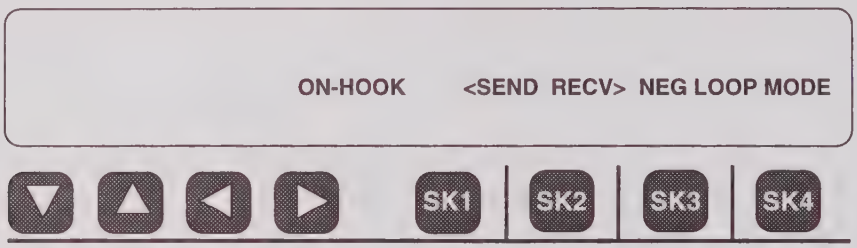
6-23.6 Remote Terminal (RT), Single Party Mode

If in **RT, SINGLE** party mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **UNEQUIPPED, ON-HOOK,** or **OFF-HOOK.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Central Office Terminal (COT) mode, see **Section 6-23.1**.

6-23.7 Remote Terminal (RT), Coin Mode

If in **RT, COIN** mode, the display shows:



Press the Up/Down arrow keys to scroll through the customer states: **UNEQUIPPED, ON-HOOK,** or **OFF-HOOK.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Central Office Terminal (COT) mode, see **Section 6-23.1**.

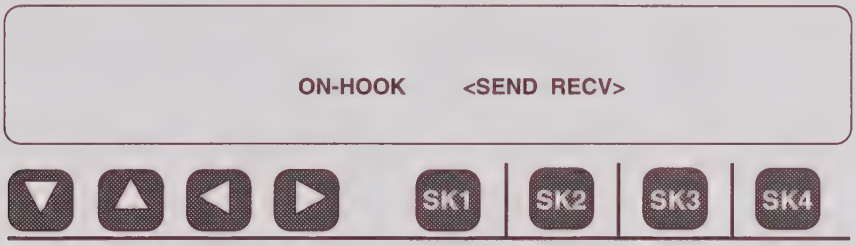
6-23.8 Remote Terminal (RT), UVG, Ground Start Mode

If in **RT, UVG, GROUND START** mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **UNEQUIPPED, ON-HOOK, RING GROUND,** or **OFF-HOOK.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Central Office Terminal (COT) mode, see **Section 6-23.1.**

6-23.9 Remote Terminal (RT), UVG, Loop Start Mode

If in **RT, UVG, LOOP START** mode, the display shows:



Press the Up/Down arrow keys to scroll through the customer states: **UNEQUIPPED, ON-HOOK, RING GROUND,** or **OFF-HOOK.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Central Office Terminal (COT) mode, see **Section 6-23.1.**

6-23.10 Remote Terminal (RT), DID Mode

If in **RT, DID** (Direct Inward Dial) mode, the display shows:

Press the Up/Down arrow keys to scroll through the customer states: **NORMAL BATT** (battery) or **REVERS BATT.** Press softkey 1 or 2 to **SEND** the selected customer state. The cursor will flash. Press softkey 1 or 2 to discontinue sending; the cursor will cease flashing. The receiver will constantly display all valid commands as they are received. For information on Central Office Terminal (COT) mode, see **Section 6-23.1**.

6-24 OPTION MENU #: 24 POST TPT DELAY

This option allows specification of the amount of time the 930A pauses between detecting the TPT from a 105-type responder and sending command MF digits. The time setting affects **OPTION MENU #: 27 ROTL RESPONDER, OPTION MENU # 2: SEND DIGITS** and **OPTION MENU #: 50 BATCH MODE** if the call sequence specifies termination on a 105 test line.

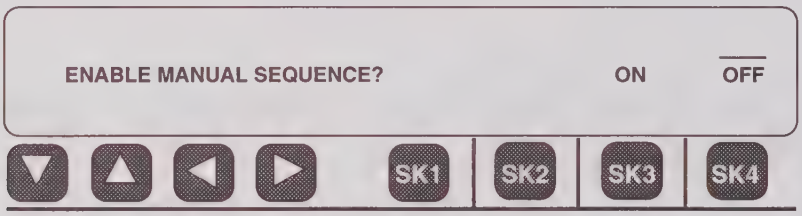
Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **24** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

The valid parameters range from **0.1 SEC** to **99.9 SEC** with a default of **1.2 SEC**. Use the numeric keypad and the **ENT** key to change the display value. Press softkey 3 for the default value. Press softkey 4 under **EXIT** to return to the main screen.

6-25 OPTION MENU #: 25 FAR END RESPONDER

If *Purchased Option 930A-12, ROTL Responder Interrogator* is installed, your 930A may be configured as a Type 105 Far End Responder and controlled by any CAROT compatible ROTL. The 930A can also provide this function directly on a T1 PCM channel. The 930A can measure Loss, Noise, Noise with Tone, Gain-Slope, and Return Loss.

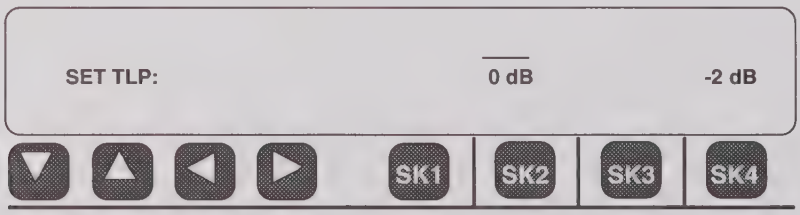
Refer to **Section 3, Function Key Operation** and **Section 5, PCM Operation** for the correct Trunk Type set-up in Responder mode. Connect the 930A to the circuit. After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **25** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



The manual sequence is normally **OFF**. To continue with the set-up, press softkey 4. The 930A always functions in the automatic sequence mode. Manual sequence provides a means for performing single direction tests and is most useful for PBX testing.

6-25.1 PCM

If you want to enable manual sequence, press softkey 3 under **ON**. In either case, if the 930A is in PCM, the 930A will prompt you as shown below:



Press softkey 2 to select **0 dB** or softkey 4 to select **-2 dB** TLP. Press softkey 1 to advance to the next display without changing any parameters. If **-2 dB** is selected, the 930A inserts a 2 dB pad into its input and output paths.

6-25.2 Analog

If you are in an analog Trunk Type, you will see the following screen:

If you press softkey 1, the screen will advance to the next display without changing any parameters. Press softkey 3 under **USER** if you need to set a Send or Receive TLP value other than the standard 0 dB or -2 dB values. The next screen will show:

To change the **SEND** TLP, press softkey 1 and then enter the desired TLP using the keypad. Press **ENT** or any softkey to complete the selection. The valid range is **-25 dBm** to **+7 dBm**. To change the **RECV** TLP, press softkey 3 and enter the desired TLP from the keypad. Press **ENT** or any softkey to complete the selection. The valid range is from **-16 dBm** to **+7 dBm**. When you have finished, press softkey 4 to **EXIT** and the display changes to:

Press softkey 3 to enable the Far End Responder. A cursor will appear over the **ON** indication. The 930A is now acting as a Type 105 Responder waiting to be accessed. The above display appears regardless of whether or not the 930A is in manual sequence mode. Press softkey 3 to enable the responder function.

When accessed by ringing or far-end seizure, the 930A goes off-hook and responds with a 2225 Hz test progress tone (TPT). The 930A then waits for MF commands and performs the corresponding Type 105 tests. The 930A will continue in this mode until:

1. It is released by the calling party via an MF "release" command.
2. The calling party goes on-hook (see following notes).
3. No MF command is received for 20 seconds (930A defaults to Manual mode if selected).
4. The operator selects **OFF** or discontinues testing in any way.

When the 930A is released, or the calling party goes on-hook, the 930A goes on-hook for one second and then awaits seizure or ringing. If the 930A is allowed to time out (20 seconds without an MF command), it will either go on-hook, or initiate the manual test sequence (if selected).

> *If the 930A is on a loop trunk simulating the subscriber (providing* ***CONTACT*** *rather than* ***BATTERY****), it will expect the far end to remain on-hook, and will not treat this as a release condition.*

For PBX testing, the manual mode sequence is most useful. If the manual mode has been selected, the responder is allowed to time out (no MF command is sent) for 20 seconds or more. The 930A then provides the manual trunk test tone sequence shown below:

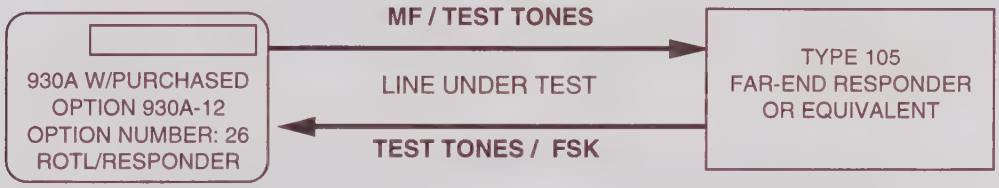
1. 9 seconds of 1004 Hz tone at -16 dBm0.
2. 1 second of quiet termination.
3. 9 seconds of 404 Hz tone at -16 dBm0.
4. 1 second of quiet termination.
5. 9 seconds of 2804 Hz tone at -16 dBm0.
6. 30 seconds of quiet termination.
7. Short burst of TPT (2225 Hz) signaling end of sequence.
8. On-hook.

If the manual test sequence is not enabled, the 930A will return to the on-hook state after a 20 second time out.

Press the **Option Menu** function key to exit this option.

6-26 OPTION MENU #: 26 ROTL/RESPONDER

With *Purchased Option 930A-12, ROTL/Responder Interrogator*, the 930A can also perform the functions of a ROTL/near-end responder. The 930A can access a 105 far-end responder and supply the MF signaling necessary to initiate Loss, Gain/Slope, C-message Noise, Noise with Tone, and Return Loss measurements. A typical connection is shown below:

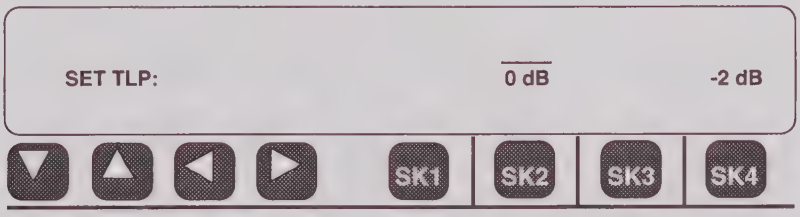


To set the 930A up as a ROTL/near-end responder, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **26** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press softkey 3 under **SET-UP**.

6-26.1 PCM

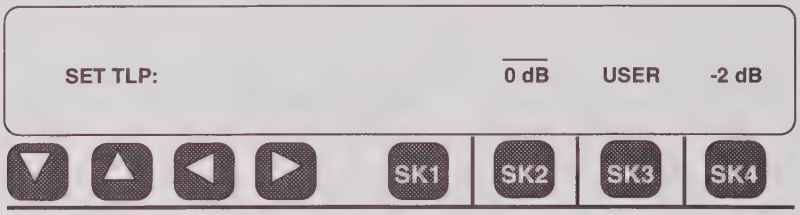
If you are in PCM, you will see:



Press softkey 2 if the set is connected at a 0 dB point, or softkey 4 if the set is connected at a -2 dB point. Press softkey 1 to advance to the **TESTS** display without changing any parameters. Skip to **Section 26.3.**

6-26.2 Analog

If you are in an analog Trunk Type, you will see:

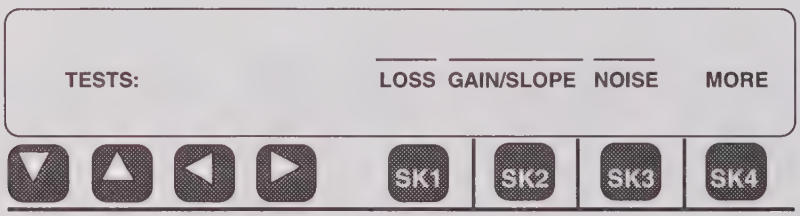


If you press softkey 1, the screen will advance to the next display without changing any parameters.

Press softkey 3 under **USER** to set the Send or Receive TLP values to other than **0 dB** or **-2 dB**. The 930A display will change to:

Press softkey 1 to change the **SEND** TLP. The valid range is **+7 dBm** to **-25 dBm**. Use the keypad to enter your choice and press **ENT** or any softkey to complete the selection. Press softkey 3 to change the **RECV** TLP. The range is **+ 7 dBm** to **-16 dBm**. Use the keypad to enter your selection and then press **ENT** or any softkey. When you have finished, press softkey 4 under **EXIT**.

6-26.3 Tests



The default parameters will show all tests to be selected. To deselect or re-select a test, press the softkey directly beneath the test. Press softkey 4 under **MORE** to advance to the next series of tests:

The default will show all tests deselected. You can select any or all of the return loss measurements by pressing their associated softkeys Press softkey 1 under **ERL** for Echo Return Loss, softkey 2 under **SRL LO** for Singing Return Loss-Low and/or softkey 3 under **SRL HI** for Singing Return Loss-High. A cursor will appear over your selection(s).

6-26.3.1 Extended 105 Responder Tests

The following tests are available only if the far-end is an Extended 105 (105E) Responder, such as the Sage Instruments 356E Responder.

Press softkey 4 under **MORE** to advance to the next screen:

The default will show all tests deselected. You can select any or all of the measurements by pressing their associated softkeys Press softkey 1 under **FREQ SWP** for Attenuation Distortion, softkey 2 under **S/N** for Signal-to-Noise and/or softkey 3 under **3K FLAT** for 3 kHz Flat Noise. A cursor will appear over your selection(s).

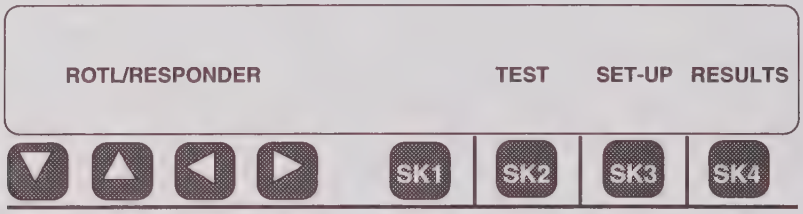
Press softkey 4 under **MORE** to advance to the next screen:

The default will show all tests deselected. You can select any, or all, of the measurements by pressing their associated softkeys Press softkey 1 under **P/AR** for Peak-to-Average Ratio, softkey 2 under **INTERMOD** for Intermodulation Distortion and/or softkey 3 under **JIT HI** for Phase/Amplitude Jitter 20-300 Hz. A cursor will appear over your selection(s).

Press softkey 4 under **MORE** to advance to the next screen:

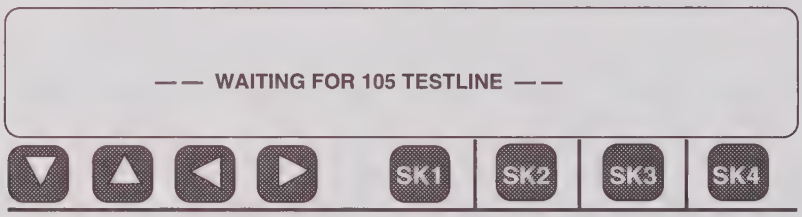
The default will show all tests deselected. You can select any or all of the measurements by pressing their associated softkeys Press softkey 1 under **JIT LO** for Phase/Amplitude Jitter 4-300 Hz, softkey 2 under **EDD** for Envelope Delay Distortion and/or softkey 3 under **IMP/HITS** for Impulse Noise/Hits. A cursor will appear over your selection(s).

The set-up phase of the test procedure is complete after the tests have been selected. Test selection need not be repeated unless the TLP changes, or different tests are desired. Pressing softkey 4 under **MORE** returns you to the main set-up menu.



Place the hookswitch in the **On Hook** position. Press softkey 2 under **TEST**. If you are not correctly connected to a 105 test line, the display will briefly show:

The display will then read:

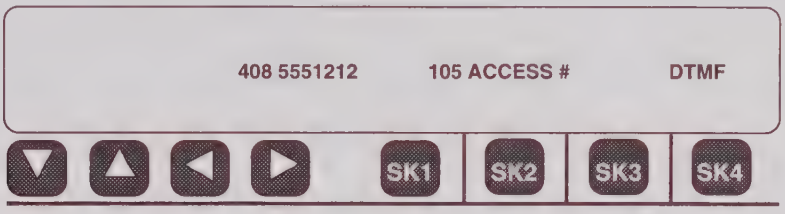


After 60 seconds, or if you press softkey 1, you will be returned to the main set-up menu. If you press softkey 2, you will initiate another test. If you have not connected to the proper test line, pressing softkey 2 will repeatedly give you the same message. If you press softkey 3, you will be returned to the **SET TLP** display. You may scroll through the options again or press **Option Menu** function key to exit back to the main set-up menu.

If you are correctly connected to a 105 test line, the 930A display will show:

The digit sequence may be DP, MF or DTMF. Select the appropriate type of signaling using softkey 4. In the example above, DTMF outpulsing has been selected.

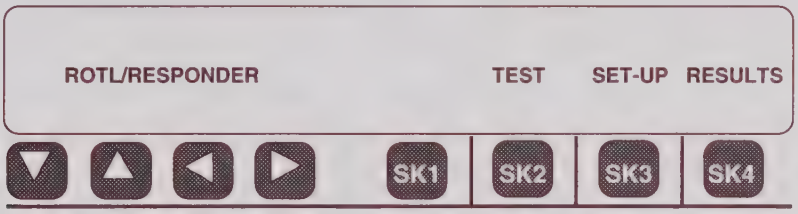
Enter the phone number of the far end test line using the numeric keypad. An example of a DTMF phone number is shown below:



After you have entered the correct phone number, place the front panel hookswitch in the **Off Hook** position to seize the line and send the call.

Press softkey 2 under **TEST**. When the far-end has been accessed, you will hear a series of test progress tones as the 930A goes through the series of tests which were programmed.

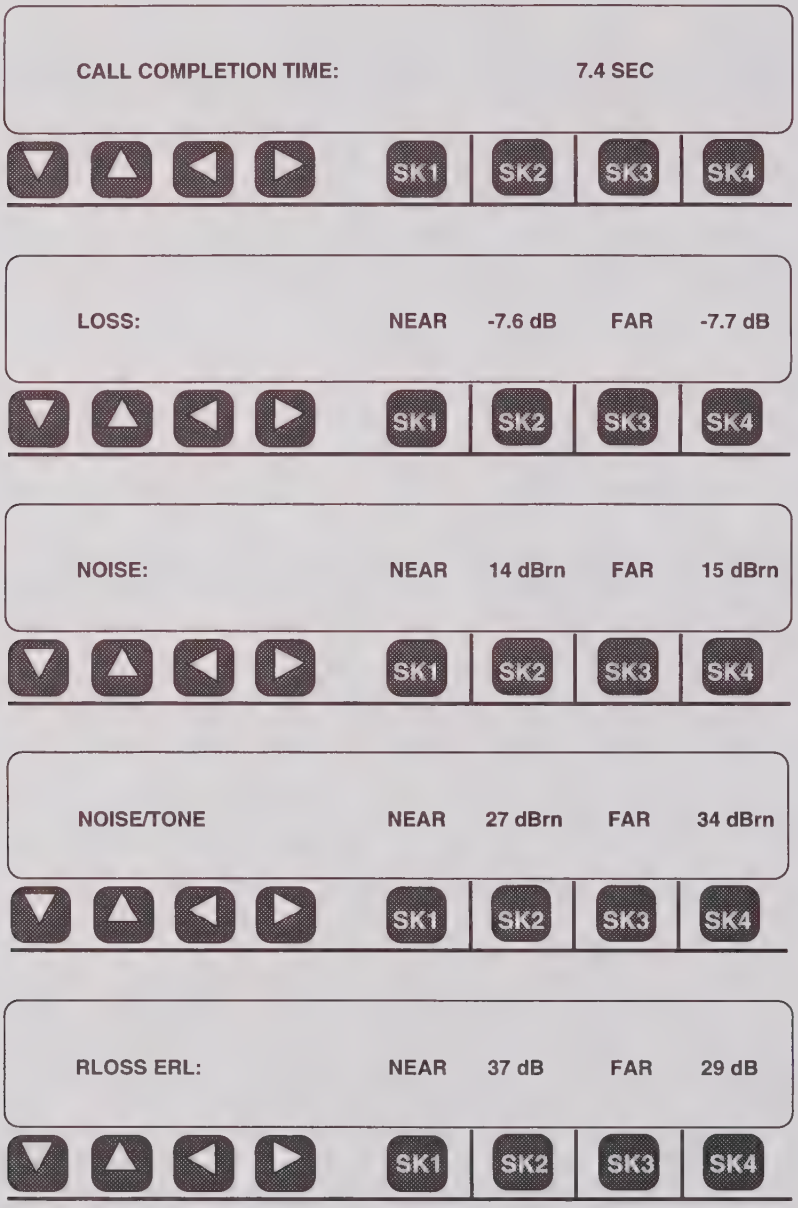
2-26.4 Results



Press softkey 4 under **RESULTS**. The test results will be displayed, including the test duration and the time. If no tests are made before selecting **RESULTS**, the display will read **NO RESULTS 00:00**. Press any softkey to return to the above screen.

6-26.4.1 Example: Results

As an example test, select only Loss, Noise and Noise with Tone, and Echo Return Loss measurements. The following series of displays will be shown on the 930A as it performs each measurement. Notice that **CALL COMPLETION TIME** is measured first.


CALL COMPLETION TIME: 7.4 SEC
SK1 SK2 SK3 SK4
LOSS: NEAR -7.6 dB FAR -7.7 dB
SK1 SK2 SK3 SK4
NOISE: NEAR 14 dBrn FAR 15 dBrn
SK1 SK2 SK3 SK4
NOISE/TONE NEAR 27 dBrn FAR 34 dBrn
SK1 SK2 SK3 SK4
RLOSS ERL: NEAR 37 dB FAR 29 dB
SK1 SK2 SK3 SK4

The **NEAR** results equate to Far-to-Near results given by CAROT. Similarly, the **FAR** results equate to the near-to-far results.

The 930A sequences through these tests and flashes the results briefly. The results are also stored in battery-backed CMOS RAM. If a printer is connected, the test results will be printed out as they occur.

See **Section 7, Remote Control Operation** for more information. Once the sequence of tests has been completed the 930A releases the far-end responder. When complete, the 930A returns to the main display.

To view the results of the tests (which flashed by during testing), press softkey 4 under **RESULTS**. The 930A will recall the stored results of the previous test sequence. Use the Up arrow key or any softkey to scroll up through the various test results. Use the down arrow key to backtrack or go backwards through the results. If at any point you want to start over at the beginning of the results, press the Right or Left arrow key. You will be taken to the first test result after **CALL COMPLETION TIME**. For instance, while reviewing the results of the previous Example Test, pressing the Left or Right arrow key would bring up:

Press the **Option Menu** function key to exit from the results option.

Return Loss testing is not standard in all far-end responders. A "failed" response from the 930A means the far-end does not have Return Loss capability. Press the **Option Menu** function key to return to the main menu and begin testing toward standard responders. If you are testing toward a Sage Instruments 356E Far End Responder or another 930A, press softkey 4 under **MORE** to select additional tests in the set-up menu.

The standard code 105 transmission tests which can be performed by the 930A are briefly described below:

1. LOSS tests the two-way loss at 1004 Hz, 0 dBm.
2. GAIN/SLOPE tests the two-way loss at 404 Hz, 1004 Hz, and 2804 Hz. All tone levels are at -16 dBm.
3. NOISE tests C-Message noise in both directions and tests two-way C-Notch noise using a -16 dBm, 1004 Hz holding tone.
4. ERL, SRL-LO and SRL-HI tests the two-way return loss for each of the three types.

The enhanced responder transmission tests also include the following:

5. FREQ SWP tests two-way attenuation distortion.
6. S/N tests two-way signal-to-noise ratio.
7. 3K FLAT tests 3 kHz flat-weighted noise in both directions.
8. P/AR tests Peak-To-Average ratio in both directions.
9. INTERMOD tests two-way 4-Tone Intermodulation Distortion.
10. JIT HI tests phase and amplitude jitter in 20-300 Hz band in both directions.
11. JIT LO tests phase and amplitude jitter in 4-300 Hz band in both directions.
12. EDD tests Forward and Return Reference Envelope Delay.
13. IMP/HITS tests three-level Impulse Noise, Phase Hits, Gain Hits, and Dropouts in both directions. Test length and other parameters are user selectable.

6-27 OPTION MENU #: 27 ROTL INTERROGATOR

The Interrogator portion of *Purchased Option 930A-12, ROTL/Responder* lets the 930A command a ROTL from a ROTL access port or over a dial-up line. The 930A supports two-way transmission testing to type 105 test lines and one-way transmission testing to type 100 and 102 test lines. Operational Balance and Long Term (BALT) tests can also be performed, but support for these tests is limited to the return of audible tones to the operator. A typical test line arrangement showing the 930A connected to the near end switch ROTL access port is shown below.

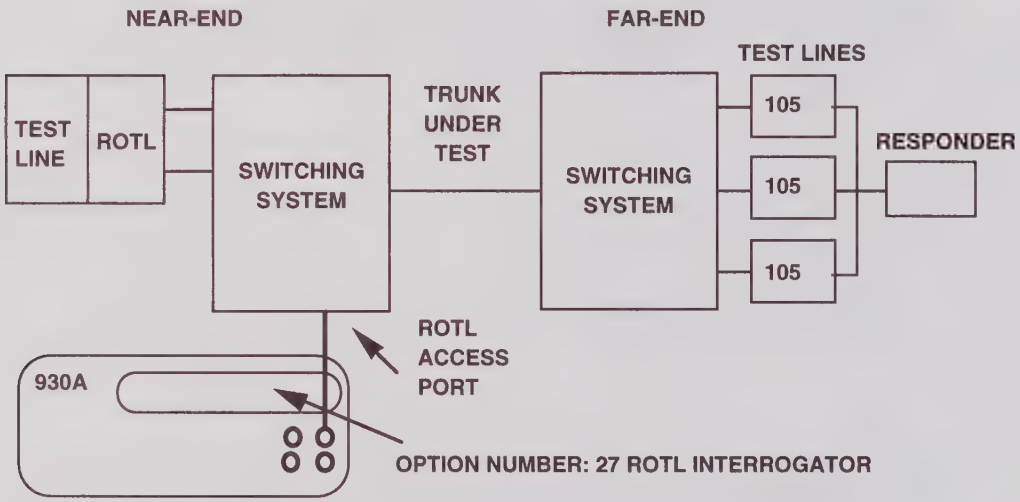
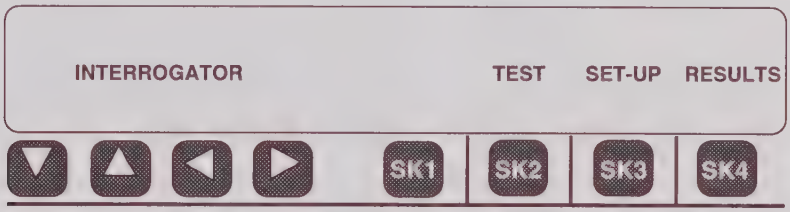


Figure 27.1
INTERROGATOR CONNECTED AT ROTL ACCESS PORT

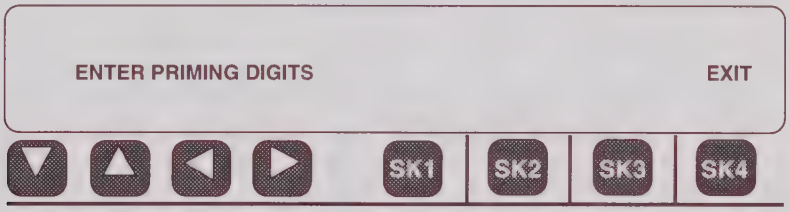
Since the ROTL access port is usually tied up by the CAROT controller, the 930A can gain test access over any dial-up line, or T1 PCM channel at the DSX, and interrogate the ROTL from there.

Before starting to test, you must set the 930A to the correct Trunk Type. Connect the 930A to either the ROTL access port, the dial-up line, or the DSX (select the Trunk Type for the connection between the 930A and the ROTL, not the line under test).

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **27** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



Place the hookswitch in the **On Hook** position. Press softkey 3 under **SET-UP**. The 930A display will then briefly flash **ROTL PRIMING DIGITS**. If no priming digits have been entered, the display will prompt you by showing the following:

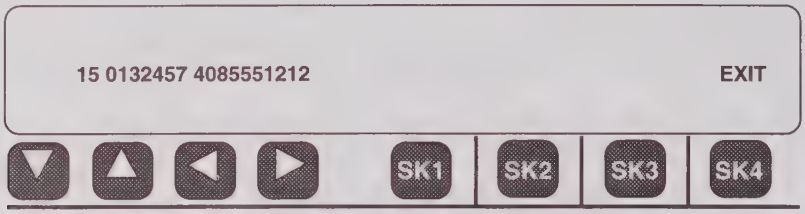


If priming digits had previously been entered, the last string of priming digits will show instead of the above display. If an unwanted string of digits is present, they can be removed by pressing the **CLR** key. New ROTL priming digits may now be entered by using the numeric keypad.

> *ROTL priming digits are always MF digits. The 930A has been set to automatically insert the KP and ST delimiters. You only have to enter the numerical digits. This is a deviation from the way in which the **Dial/Ring** function operates.*

You can enter up to 30 digits in the ROTL priming digits field. These digits consist of the test type (up to 3 digits long), the trunk identification number (up to 7 digits long) and the far-end test line number (up to 11 digits long). The 930A lets you enter blank characters between the groups for readability. These blank characters are inserted by the Up arrow key and have no affect on outpulsing.

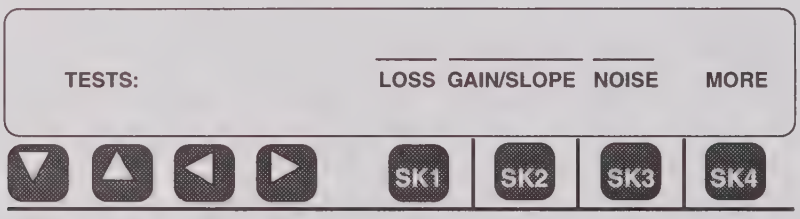
A typical 930A display of ROTL priming digits, with blank spaces inserted to separate the groups, might appear as shown below:



In this example, the first two digits identify the test type (in this case, transmission test with busy override using a 105 type test line), the second group of 7 digits might be the trunk appearance number of a No. 4 ESS for example, and the last group is an example of a far-end test line number. ROTL priming digit sequences vary in accordance with the type and vintage of switching equipment, the type of testing to be performed, the test lines available and their manufacturer. A number of application specific examples and tables of priming digit formats are provided at the end of this section.

You can edit the string of priming digits to insert or delete individual characters, rather than re-entering the entire string if a mistake or an omission has occurred. The Left and Right arrow keys move the cursor. The Up arrow key inserts a blank space. The Down arrow key deletes an unwanted digit. When your entry is complete, press softkey 4 under **EXIT**. The display will read:

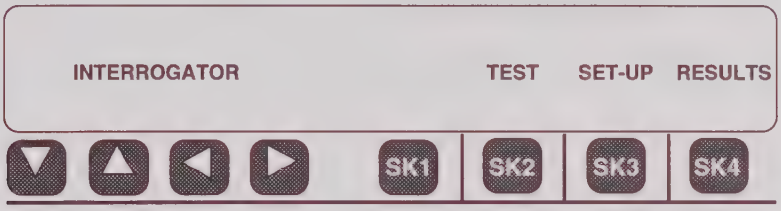
Press softkey 1 to scroll through the **TEST LINE** options of **100**, **102**, and **105**. Press softkey 2 to choose between **0 dB** and **-2 dB**. Press softkey 3 to choose between **600** and **900 Ohms**. The above display is the default. When your selection is complete, press softkey 4 under **EXIT**. You will advance to the first of two **TESTS** screens:



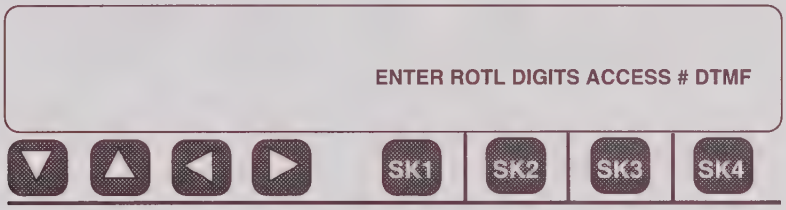
The default parameters will show all tests to be selected. To reselect or deselect a test, press the softkey directly beneath the test.

Press softkey 4 under **MORE** to advance to the next series of tests:

The default will show all tests deselected. Any or all of the return loss measurements may be selected by pressing their associated softkeys Press softkey 1 under **ERL** for Echo Return Loss, softkey 2 under **SRL LO** for Singing Return Loss-Low and/or softkey 3 under **SRL HI** for Singing Return Loss-High. A cursor will appear over your selection(s). Press softkey 4 under **MORE** to return to the main menu.



Press softkey 2 under **TEST** and you will see:



Press softkey 4 to choose between **DTMF**, **MF** and **DP**. Use the numeric keypad to enter the digits. Put the hookswitch in the **Off Hook** position. You will hear a tone and see a display similar to the following:

Press softkey 4 under **SEND** to send the priming digits. The tests will be displayed on your screen.

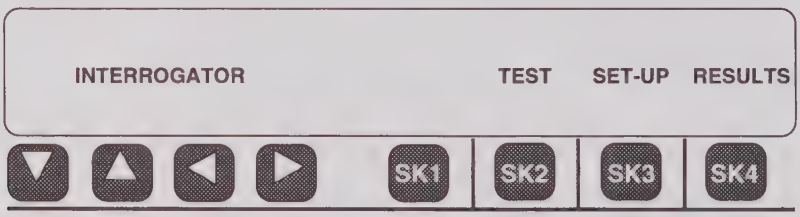
When all the tests are complete, you will see the following display:

Put the hookswitch in the **On Hook** position. To repeat the previous process, go **Off Hook** again and press softkey 1 under **REPEAT**.

Put the hookswitch in the **On Hook** position. Press softkey 2 under **RECYCLE** to return to the priming digits display. At this point you may enter new priming digits. Go **Off Hook** , wait for the tone and press softkey 4 under **SEND** and the process will repeat.

Press softkey 3 under **MANUAL** to perform each test one at a time. You will see the following display:

Press softkey 2 under **LOSS** to scroll through the different tests available. Press softkey 3 under **TEST** when you are ready to perform that individual test. Press softkey 4 under **EXIT** when testing is complete. Press **EXIT** again to return to the main menu.



Press softkey 4 under **RESULTS** to see the results of your tests. In **PRINTER** remote mode, the results of each test will be sent to the printer as they occur. In **COMPUTER** remote mode, a bell will be sent to the computer at the conclusion of each test. The test results can be read from the display at that time. See **Section 7, Remote Control Operation** for more information.

> **OPTION MENU #: 3 REMOTE CONTROL** *will tell you what mode you are in:* **TERMINAL, MASTER, SLAVE, ATR, COMPUTER, PRINTER**, *or* **OFF** *(not in remote control).*

The format of the possible results is:

LOSS:	NEAR	+nn.n	dB	FAR	+nn.n	dB
SLOPE 404:	NEAR	+nn.n	dB	FAR	+nn.n	dB
SLOPE 1004:	NEAR	+nn.n	dB	FAR	+nn.n	dB
SLOPE 2804:	NEAR	+nn.n	dB	FAR	+nn.n	dB
NOISE:	NEAR	nn	dBrn	FAR	nn	dBrn
NOISE/TONE:	NEAR	nn	dBrn	FAR	nn	dBrn

The NEAR measurement is the far-to-near measurement and the FAR measurement is the near-to-far measurement.

6-27.1 Tables of ROTL Priming Digits

The following tables are intended for two-way Transmission. They are not complete lists of all ROTL Priming Digits for all types of tests such as Terminal Balance, Connection Appraisal, etc.

TEST TYPE	TEST LINE	DIGITS																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
TRANSMISSION TESTS	100	0	0	0	TRUNK ID			*	FAR-END TESTLINE NUMBER										
	102	0	2	0															
	105	0	5	0															

DIGITS	TRUNK TYPE
0	Dial Pulse on Loop Supervision Trunk
1	Dial Pulse on Loop Supervision with Stop Dial
2	Dial Pulse on Simplex Supervision Trunk
3	Dial Pulse on Simplex Supervision with Stop Dial
4	MF Signaling on Loop Supervision Trunk
5	MF Signaling on Simplex Supervision Trunk

** The seventh digit depends upon the Trunk Type.*

Figure 27.1
STEP-BY-STEP OFFICE MINI-ROTL PRIMING DIGIT FORMAT

<table>
<tr><th>TEST TYPE</th><th>Line</th><th>1 2</th><th>3</th><th>4 5 6 7</th><th>8 9 10 11</th><th>12 13 14 15 16 17 18</th></tr>
<tr><td rowspan="2">TRANSMISSION TESTS</td><td>100
102
105</td><td>0 0
0 2
0 5</td><td>0
0
0</td><td rowspan="4">TRUNK GROUP NUMBER</td><td rowspan="4">MEMBER NUMBER</td><td rowspan="4">FAR-END TEST LINE NUMBER</td></tr>
<tr><td>OUT OF SERVICE OVERRIDE</td><td>100
102
105</td><td>1 0
1 2
1 5</td><td>0
0
0</td></tr>
<tr><td>CONNECTION APPRAISAL</td><td>100
102
105</td><td>6 0
6 2
6 5</td><td colspan="3">FAR-END TEST LINE NUMBER < 12 DIGITS</td></tr>
</table>

Figure 27.2
5ESS PRIMING CHART

TEST TYPE	TEST LINE	DIGITS																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
TRANSMISSION TESTS	100	0	0	TRUNK ID				*	FAR-END TESTLINE NUMBER										
	102	0	2																
	105	0	5																
TRANSMISSION TESTS WITH BUSY OVERRIDE	100	1	0																
	102	1	2																
	105	1	5																

DIGITS	TRUNK TYPE
0	Dial Pulse on Loop Supervision Trunk
1	Dial Pulse on Loop Supervision with Stop Dial
2	Dial Pulse on Simplex Supervision Trunk
3	Dial Pulse on Simplex Supervision with Stop Dial
4	MF Signaling on Loop Supervision Trunk
5	MF Signaling on Simplex Supervision Trunk

** The seventh digit depends upon the Trunk Type.*

Figure 27.3
STEP-BY-STEP OFFICE EXPANDED FORMAT

TEST TYPE	TEST LINE	DIGITS			
		1 2	3	4 5 6 7 8 9	10 11 12 13 14 15 16 17 18 19 20
TRANSMISSION TESTS	100	0 0	*	TRUNK NETWORK NUMBER	FAR-END TEST LINE NUMBER
	102	0 2			
	105	0 5			
TRANSMISSION TESTS WITH BUSY OVERRIDE	100	1 0			
	102	1 2			
	105	1 5			

** The third digit is a modifier digit:*

1) 0 = Local originating mode.
2) 1 = Tandem 1 (2-wire tandem configuration with transformers).
3) 2 = Tandem 2 (4-wire to 2-wire tandem configuration without transformers).

Figure 27.4
NO. 1 ESS ROTL PRIMING DIGITS FORMAT

TEST TYPE	TEST LINE	DIGITS		
		1 2	3 4 5 6 7 8 9	10 11 12 13 14 15 16
TRANSMISSION TESTS	100	0 0	TRUNK ID FOR TRUNK APPEARANCE NUMBER	FAR-END TESTLINE NUMBER
	102	0 2		
	105	0 5		
TRANSMISSION TESTS WITH BUSY OVERRIDE	100	1 0		
	102	1 2		
	105	1 5		

Figure 27.5
NO. 4 ESS ROTL PRIMING DIGITS FORMAT

TEST TYPE	TEST LINE	DIGITS																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TRANSMISSION TESTS	100	0	0	NOTE 1	N	O	T	N	O	T	FAR-END TEST LINE NUMBER										
	102	0	2																		
	105	0	5																		
TRANSMISSION TESTS WITH BUSY OVERRIDE	100	1	0		E			E													
	102	1	2																		
	105	1	5		2			3													

NOTE 1: The third digit is a modifier:
1) 0= Talk tandem Off-Hook state without a transformer in the talk path.
2) 1= Talk tandem Off-Hook state with a transformer in the talk path.

NOTE 2: Three digit Trunk Group Number.

NOTE 3: Three digit Trunk Group Member Number.

Figure 27.6
GTD-5, ITT 1210 PRIMING DIGITS FORMAT

TEST TYPE	TEST LINE	DIGITS			
		1 2	3 4 5 6	7 8 9 10	11 12 13	14 15 16 17 18 19 20 21
TRANSMISSION TESTS	100 102 105	0 0 0 2 0 5	TRUNK GROUP NMBR	TRUNK GROUP MEMBER NUMBER	NOT SENT TO DMS 100/200	FAR-END TESTLINE NUMBER
TRANSMISSION TESTS WITH BUSY OVERRIDE	100 102 105	1 0 1 2 1 5				

Figure 27.7
DMS 100/200 ROTL PRIMING DIGITS FORMAT

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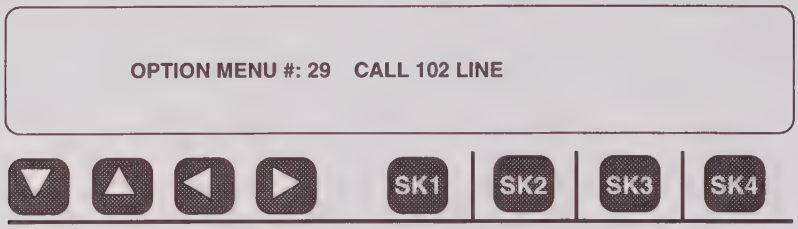
6-29 OPTION MENU #: 29 CALL 102 LINE



This option was added to Batch Mode to allow easy access to type 102 test lines, commonly known as milliwatt lines. These are dial-up test lines that return a nominal 1004 Hz signal at 0 dBm.

To begin testing, connect the 930A to the trunk under test and select the correct Trunk Type. After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **29** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

If you have not previously set-up for a test, press softkey 3 under **SET-UP**. You will see this display:

LOSS tests are performed at 1004 Hz. **C-NOTCH** measures C-Notch noise. **S/N** measures signal-to-noise ratio. The default parameters will show all tests to be selected. To deselect a test, press the softkey directly beneath the test. Press softkey 4 under **EXIT** to return to the main display.

In **COMPUTER** *remote mode (as set-up in* **OPTION MENU # 3: REMOTE CONTROL***), all previous selections will be cleared when the softkey under* **SET-UP** *is pressed. Send an ASCII* **J** *to select* **LOSS**, *an ASCII* **K** *to select* **C-NOTCH**, *and an ASCII* **L** *to select* **S/N**.

When all the selections are made, press Softkey 4 under **EXIT**. *Your set-up will be retained in battery-backed CMOS RAM. You will not need to use the SET-UP function again unless you wish to change the set-up.*

You will be returned to the main set-up menu. The hookswitch should be in the **On Hook** position. If the 930A is already **Off Hook** when you press **TEST**, it will send any displayed digits immediately.

When you are ready to begin testing, press softkey 2 under **TEST**. You will see a display similar to:

The number most recently entered in the **DIAL/RING** mode will usually be displayed in place of the word **ENTER**. Press the **CLR** key to remove any previous entry and return to a display similar to the one above.

Press softkey 4, labeled **MF**, **DTMF**, or **DP**, to change the outpulsing format to the type required for your circuit. This will also clear any old numbers.

Enter the access number of the far-end transponder using the numeric keypad.

Go off-hook with the front panel hookswitch to begin testing. The 930A will seize the line, send any digits you have entered in the window, and expect the responder at the far-end to answer the call. If no number has been entered in the window, no digits will be sent. In **PRINTER** remote mode (as set-up in **OPTION MENU #: 3 REMOTE CONTROL**), the 930A will send a time and date stamp and the current access number to the printer to identify the test. See **Section 7, Remote Control Operation** for more information.

After it has sent the displayed digits, the 930A will look for a 1004 Hz tone from the transponder. If it does not receive the tone within 60 seconds, or if it detects busy, reorder, dial tone or a tone other than 1004 Hz (less than 950 Hz or greater than 1050 Hz), it will abort the test with one of these messages:

```
ABORT: BUSY       xx.x SEC
ABORT: REORDER    xx.x SEC
ABORT: DIALTONE   xx.x SEC
ABORT: TONE       xx.x SEC
ABORT: DEAD LINE  xx.x SEC
ABORT: RINGING    xx.x SEC
ABORT: SPEECH?    xx.x SEC
```

If the 930A successfully detects 1004 Hz within 60 seconds, it will instead display the message: **CALL COMPLETION TIME: xx.x SEC**.

In **PRINTER** remote mode, a copy of the display will be sent to the printer.

In **COMPUTER** remote mode, the 930A will send a prompt ">" and a bell when it detects 1004 Hz or when it aborts a test. You may inspect the 930A display for the word **ABORT:** or **CALL** to determine which has occurred. If the display shows **CALL COMPLETION TIME:**, the **xx.x** seconds is the time from the last digit outpulsed to the receipt of the 1004 Hz envelope. If the display shows **BUSY, REORDER, DIALTONE** or **TONE**, the **xx.x** seconds is the network response time. If the display shows **DEAD LINE, RINGING** or **SPEECH?**, the **xx.x** seconds are not significant. The 930A will perform the selected tests. The results of each test will be displayed at the end of each test. In **PRINTER** remote mode, the results of each test will be sent to the printer as they occur. In **COMPUTER** remote mode, a bell will be sent to the computer at the conclusion of each test. The test results can be read from the display at that time.

The format of the possible results is:

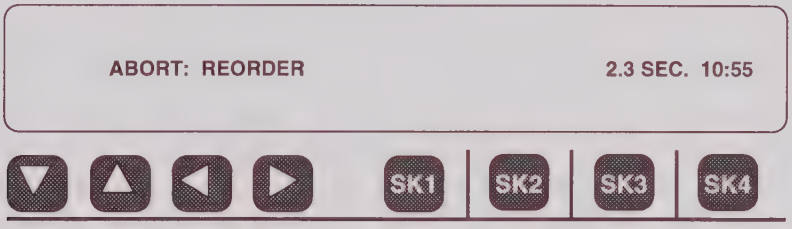
```
LOSS:           +nn.n   dB
C-NOTCH NOISE:    nn    dBrnC
SIGNAL/NOISE:     nn    dB
```

When all the selected tests have been completed, you will be returned to the main display. If the 930A was in **COMPUTER** remote mode, it sends another prompt when testing is complete.

Return the hookswitch to the **On Hook** position and release the telephone line when you finish testing.

To examine the test results, press softkey 4 under **RESULTS**. You will see either a **CALL COMPLETION TIME**, such as:

or a call failure message, such as:



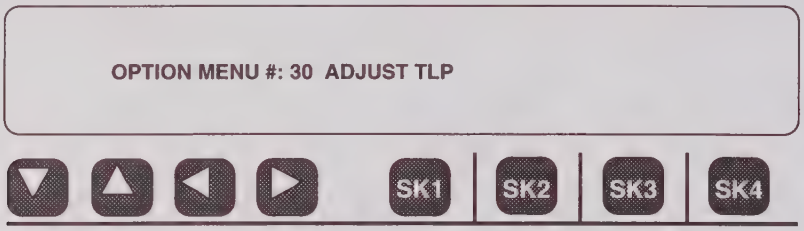
If a call failure message is displayed, there are no other results. Press the **Option Menu** function key to return to the main menu.

If the call completion time is displayed, you are seeing the time elapsed from the last outpulsed digit in the 102 access number to the receipt of the 1004 Hz envelope.

Press softkey 1 or the Up/Down arrow keys to scroll through the remaining test results.

Press the **Option Menu** function key to exit this option.

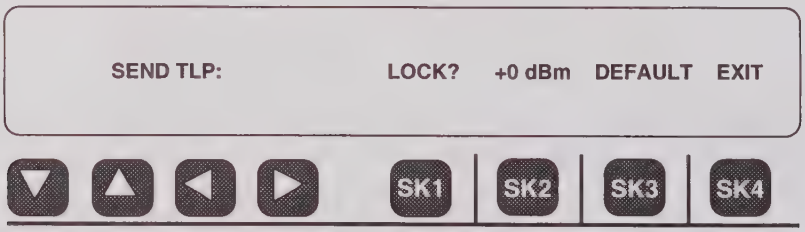
6-30 OPTION MENU #: 30 ADJUST TLP



This allows the manual adjustment of the transmission level point (TLP) compensation of the 930A and is a standard feature. The Transmit TLP affects the level the 930A sends. The Receive TLP affects the level sensitivity of the 930A receiver. This function is normally not used when testing 2-wire analog or PCM (T-Carrier) trunks since these are usually a 0 dB TLP. See **Section 3, Function Key Operation** and **Section 4, Analog Operation** for information on 4-wire set-up.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **30** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

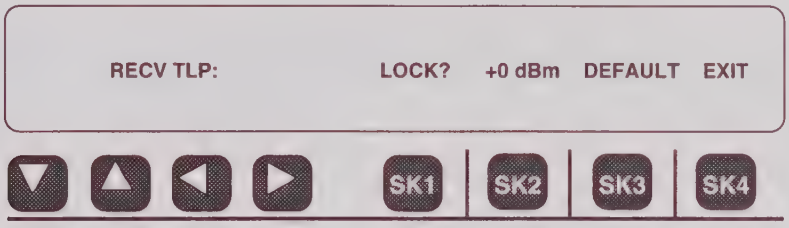
To adjust the TLP, press softkey 1 under **SEND TLP** and the 930A display will show the current TLP setting. For example:



The default TLP is **+0 dB**. To change the TLP to something other than the displayed value, use the numeric keypad (the **D** key will change the value from **+** to **-**). If you want the displayed value to remain as the start-up value, press softkey 1 under **LOCK?**. The display will change to **LOCKED**. Press **ENT**. Press softkey 3 for the default value.

Press softkey 4 under **EXIT** to return the main display.

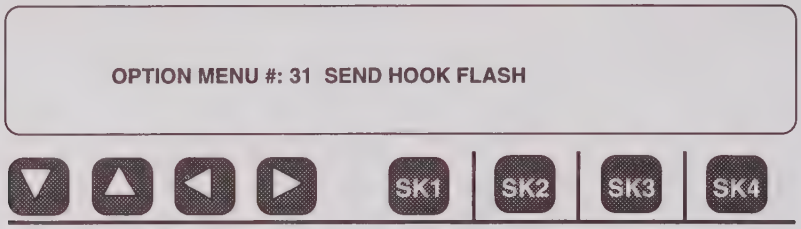
Changing the Receive TLP affects the level sensitivity of the 930A digit receiver. To change the Receive TLP, press softkey 3 under **RECV TLP** and the display will become:



The default TLP is **+0 dB**. To change the TLP to something other than the displayed value, use the numeric keypad (the **D** key will change the value from **+** to **-**). If you want the displayed value to remain as the start-up value, press softkey 1 under **LOCK?**. The display will change to **LOCKED**. Press **ENT**. Press softkey 3 for the default value. Press softkey 4 under **EXIT** to return the main display.

Press the **Option Menu** function key to exit this option.

6-31 OPTION MENU #: 31 SEND HOOK FLASH



This option enables you to send a hook flash from the 930A, allowing you to check a switch's or PBX's flash recognition capability.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **31** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press **ENT** or any softkey to bring up the main set-up menu:

The length of the hook flash default duration is **200** milliseconds but is variable from **10** to **9999** milliseconds. Change the value using the numeric keypad. Press **ENT** or any softkey when your value is chosen. Hook flashes less than 50 msecs in duration will not be indicated by the front panel supervision LEDs.

To send a hook flash of the displayed duration, press Softkey 3 under **FLASH**. This causes a hook flash to be sent from the 930A on the analog trunk or PCM channel selected (if *Purchased Option 930A-08E, Single Direction ESF* or *-09E, Dual Drop/Insert w/ESF* is installed). If the 930A hookswitch is **On Hook**, sending a hook flash causes it to go off-hook for the prescribed number of milliseconds. If the 930A hookswitch is in the **Off Hook** position, sending a hook flash causes the 930A to go on-hook during the flash. The 930A will continue to send hook flashes if the hookswitch is in the **Off Hook** position until you return the hookswitch to the **On Hook** position.

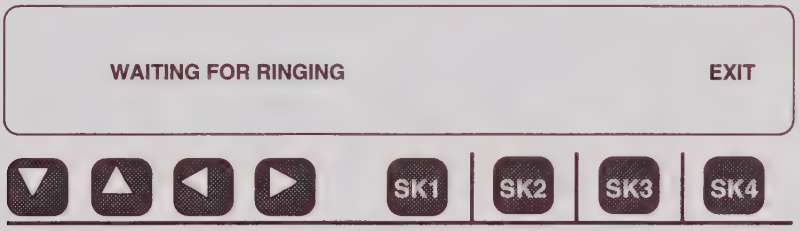
Press softkey 4 under **EXIT**, or press the **Option Menu** function key to exit the option.

6-32 OPTION MENU #: 32 DIAL-UP TESTLINE

This option allows the 930A to provide Quiet Termination or send a tone in response to ringing or seizure. That is, the 930A can act as a Type 100 or a Type 102 testline.

Use the **Send Tone** function to set-up the tone to be sent or "Quiet Termination." If the **Send Tone** function is turned off, the 930A will supply Quiet Termination. After you have set-up the **Send Tone** function, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **32** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

If the 930A is supplying battery, press **ENT** or any softkey to see **WAITING FOR SEIZURE**. If the 930A is in **CONTACT** mode, you will see **WAITING FOR RINGING.**



Entering this menu places the 930A on-hook where it will remain waiting for line seizure before going off-hook.

If the 930A tone generator has been turned **OFF**, the 930A will provide Quiet Termination when ringing or seizure is detected.

If you have selected a tone, for example, 1004 Hz at 0 dBm, and left the tone generator turned on prior to entering **OPTION MENU #: 32**, then the 930A will respond with the 1004 Hz at 0 dBm when ringing or seizure is detected.

6-33 OPTION MENU #: 33 DIAL-UP SWEEP

This feature operates exactly like **OPTION MENU #: 32 DIAL-UP TESTLINE** except that it sends back whatever sweep parameters have been set in **OPTION MENU # 10: FREQUENCY SWEEP.**

First, set the sweep up using **OPTION MENU #: 10 FREQUENCY SWEEP**. Refer to **Section 6-10, Option Menu #: 10 Frequency Sweep** for information on this function.

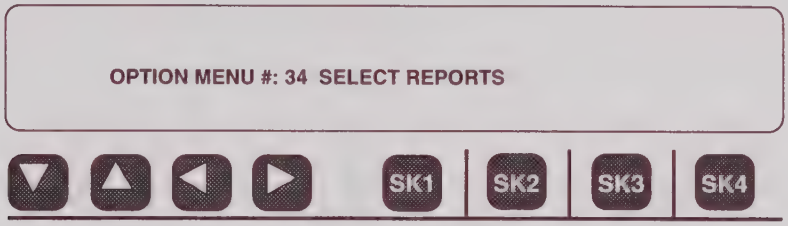
After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **33** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

If the 930A is supplying battery, the 930A will display **WAITING FOR SEIZURE**. If the 930A is in **CONTACT** mode, you will see:

When the 930A receives ringing it will send the sweep frequencies back. This will continue until the trunk is disconnected (goes back **On Hook**) and will continue as long as it is left in this menu.

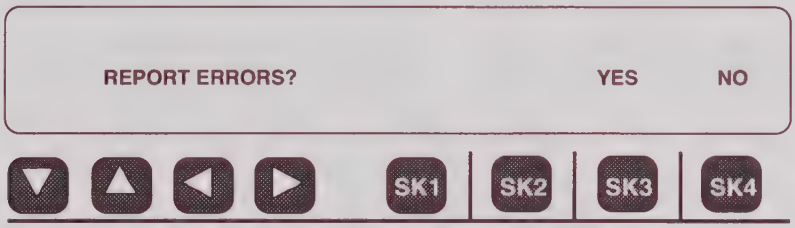
Press softkey 4 to **EXIT** from this menu and stop any sweep in progress.

6-34 OPTION MENU #: 34 SELECT REPORTS



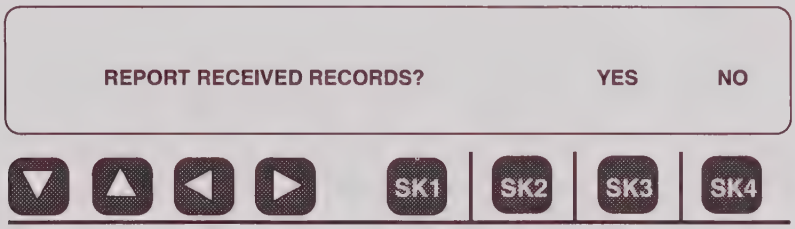
The 930A must be in the PCM Trunk Type for **Option Menu #: 34** to be valid. This option allows you to select reports for printing or review via computer terminal. Refer to **Section 7, Remote Control Operation** and **Section 6-3, Option Menu #: 3 Remote Control** for remote control set-up.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **34** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If in **COMPUTER** or **TERMINAL** remote mode, the following screen will display:



If in **PRINTER** remote mode, the screen will show **PRINT ERRORS?**

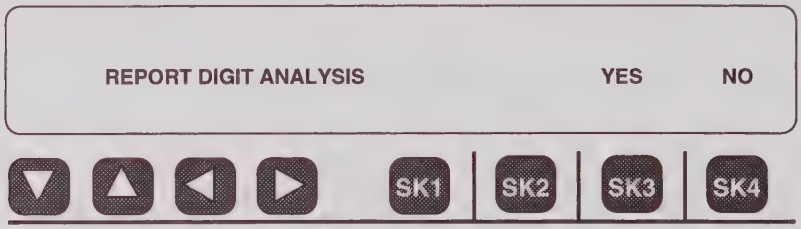
To send the PCM formatted error report, press softkey 3 under **YES**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:



If in **PRINTER** remote mode, the screen will show **PRINT RECEIVED RECORDS?**

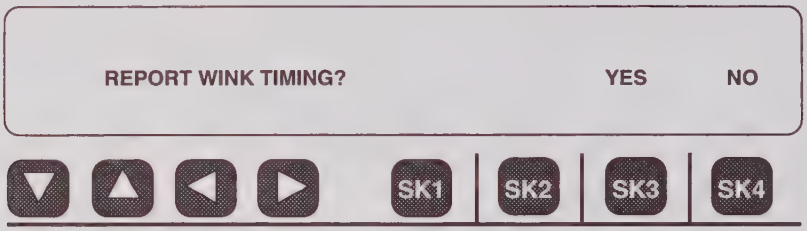
To send calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4.

Selecting **YES** displays the following screen. Selecting **NO** skips the following screen.



If in **PRINTER** remote mode, the screen will show **PRINT DIGIT ANALYSIS?**

To send the analysis of the received digits, press softkey 3 under **YES**, otherwise, press softkey 4. The 930A display advances to:



If in **PRINTER** remote mode, the screen will show **PRINT WINK TIMING?**

After selecting **YES** or **NO**, the display will return to the main **OPTION MENU #:** screen.

6-35 OPTION MENU #: 35 DUAL TONE SENDER

The 930A is capable of sending any dual tone signal if the two tones fall within the 930A frequency range. The 930A has three preset signals: Dial tone, Busy and Reorder.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **35** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press softkey 3 under **PRESET** to select and send one of the 930A's standard preset signals . The display becomes:

Make your selection by pressing the softkey directly below the tones yóu want to send. For instance, pressing softkey 2 under **BUSY** will select the trunk busy signal. You will be returned to the first set-up menu.

Go **Off Hook** with the front panel hookswitch. Press softkey 2 under **SEND**. A flashing cursor will appear over **SEND** while you are transmitting. The tone(s) will be audible through the front panel speaker.

To stop sending, press softkey 2 under **SEND** again or go **On Hook**. If testing is complete, press softkey 4 under **EXIT**.

6-35.1 Dial Tone Set-up

To change the frequency, level and pattern of the dial tone signal, first select **DIALTONE** in the **PRESET** menu. Press softkey 1 to enter the **SET-UP** display to see:

Set the level and frequency of **TONE 1**. Press softkey 1 to see:

The default values are **350 Hz** and **-16.0 dBm** for **TONE 1**. The valid frequency range is **20 Hz** to **5000 Hz**. The valid level range is **+12.0 dBm** to **-99.9 dBm**.

To change the frequency of the tone press softkey 1. Enter the desired frequency from the keypad. Press **ENT** or any softkey to complete the selection.

To change the level of the tone press softkey 3. Enter the desired level from the keypad. Press **ENT** or any softkey to complete the selection.

Press softkey 4 to exit back one screen. To change the level and frequency of **TONE 2** press softkey 2 and a display like the one below will appear:

The default values are **440 Hz** and **-16.0 dBm**. The same valid parameters apply for **TONE 2** as for **TONE 1**. Repeat the procedure previously outlined for **TONE 1** to modify **TONE 2**. When you have set **TONE 2**, press softkey 4 to exit back one screen.

6-35.1.1 Pattern Set-up

Press softkey 3 under **PATTERN** and the display will change to:

The default (preset) value for **DIALTONE** is a steady tone. Changing the pattern for **DIALTONE** is not applicable. This function will be discussed in **Section 6-35.2.1**.

6-35.2 Busy and Reorder Set-up

To change the frequency, level and pattern of the busy or reorder signal, first select **BUSY** or **REORDER** in the **PRESET** menu. Press softkey 1 to enter the **SET-UP** display to see:

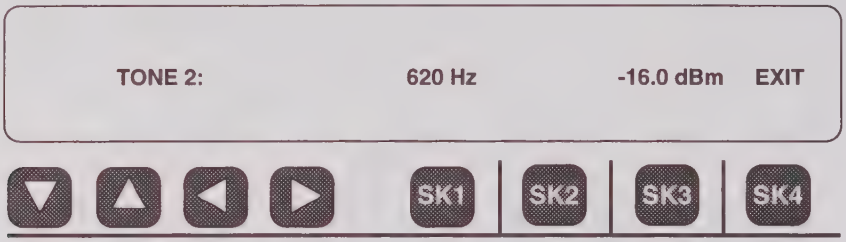
Set the level and frequency of **TONE 1**. Press softkey 1 to see:

The default values are **480 Hz** and **-16.0 dBm** for **TONE 1**. The valid frequency range is **20 Hz** to **5000 Hz**. The valid level range is **+12.0 dBm** to **-99.9 dBm**.

To change the frequency of the tone press softkey 1. Enter the desired frequency from the keypad. Press **ENT** or any softkey to complete the selection.

To change the level of the tone press softkey 3. Enter the desired level from the keypad. Press **ENT** or any softkey to complete the selection.

Press softkey 4 to exit back one screen. To change the level and frequency of **TONE 2** press softkey 2 and a display like the one below will appear.



The default values are **620 Hz** and **-16.0 dBm**. The same valid parameters apply for **TONE 2** as they did for **TONE 1**. Repeat the procedure previously outlined for **TONE 1** to modify **TONE 2**. When you have set **TONE 2**, press softkey 4 to exit back one screen.

6-35.2.1 Pattern Settings

To change the timing or pattern of the dual tone signal, press softkey 3 under **PATTERN** and the display will change to:

You can change the interval for the tones or send a continuous tone. For example, **BUSY** is sent at **500** milliseconds **OFF** and **500** milliseconds **ON** as shown above. **REORDER** is sent at **250** milliseconds **OFF** and **250** milliseconds **ON** .

To change the **OFF** and **ON** times, press softkey 1 under **OFF** and enter the desired time using the keypad. The valid range is **1** millisecond to **9999** milliseconds. Press **ENT** or any softkey to enter the value. Press softkey 2 under **ON** and repeat the above procedure.

To send a signal continuously, press softkey 3 under **STEADY**. In this case the **OFF** and **ON** times are blank.

When you have made your selections, press softkey 4 twice to exit back to the main menu to perform the test.

To send your creation, go **Off Hook** and press softkey 2 under **SEND** in the **SELECT** menu. To stop sending, press softkey 2 under **SEND** again or go **On Hook**. If testing is complete, press softkey 4 under **EXIT**.

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6-37 OPTION MENU #: 37 LINE STATUS

This option allows the 930A to Bridge or Terminate on a Metallic facility (2W/4W) Loop or a PCM Channel, and Monitor the status of the line in one direction. Typically, the 930A analyzes the received audible tones on the line and displays the condition. The following audible tones are analyzed: Dial tone, Busy, Reorder, Dead Line, Ringing, Talking or Speech Tone.

When any of the above conditions occur, the display will be in real time. If the condition changes, it will clear after a timeout and indicate the new condition. This information can be printed or sent to a computer as it occurs. Refer to **Section 7, Remote Control Operation** and **Section 6-3, Option Menu #: 3, Remote Control** for more information.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **37** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

As conditions change on the line, the screen status will update. Press the **Option Menu** function key to exit or when testing is complete.

6-38 THIS PAGE INTENTIONALLY LEFT BLANK

6-39 OPTION MENU #: 39 REMOTE AUDIO

This option requires *Purchased Option 930A-47, Remote Audio.* The Remote Audio option provides remote access to the trunk under test. This is accomplished via a separate dial-up line. This enables troubleshooting and verification from a remote location.

Remote audio access is through a standard modular telephone jack (RJ-11) located on the 930A rear panel. Refer to **Section 1-7, DC Rear Panel** for location. The modular jack provides a loop appearance. When the 930A is turned on, the remote audio line is placed on-hook. The monitor can be set to automatically answer when it detects ringing.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **39** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Flashing cursors indicate whether the audio monitor is currently on- or off-hook, and whether it has been programmed to answer or ignore incoming calls. In the above example, the remote audio line is on-hook and ready to answer incoming calls.

If the remote line has been set to answer incoming calls, it will respond to ringing by going off-hook.

Press softkey 1 to place the remote line on-hook, softkey 2 to place the Remote Line off-hook, softkey 3 to answer incoming calls, or softkey 4 to ignore incoming calls. Press the **Option Menu** function key to exit.

> *Remote Audio may be operated remotely by establishing a modem call connection from the control site. Refer to* ***Section 6-3, Option Menu #: 3 Remote Control*** *and* ***Section 7, Remote Control Operation*** *to set-up.*

The connection of the 930A for remote audio operation appears below:

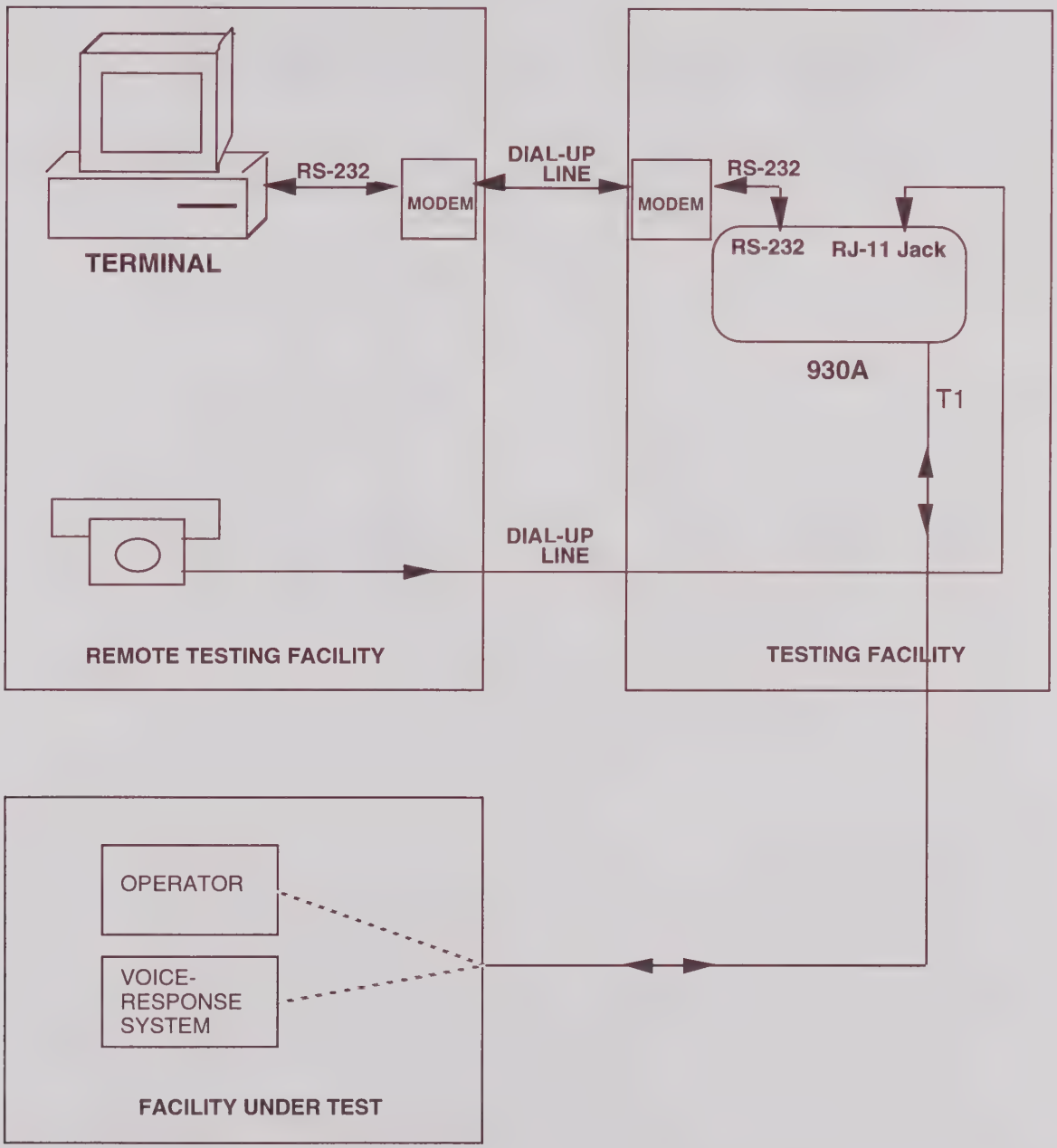
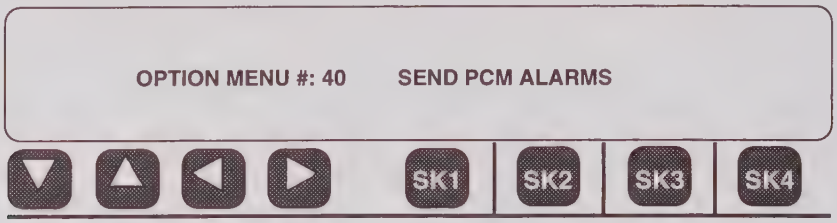


Figure 39.1
REMOTE AUDIO OPERATION

6-40 OPTION MENU #: 40 SEND PCM ALARMS



Sending Remote Alarm, Blue Alarm or forcing a Frame Slip is not intended to be done on spans carrying service. They are tests usually performed prior to turning up service on a channel bank or switch to see that their alarm indicators are working. The 930A will not allow you to send alarms or slips unless you are in the **TERMINATE** mode (out of service).

Connect your 930A as shown below and set it into the Terminate mode.

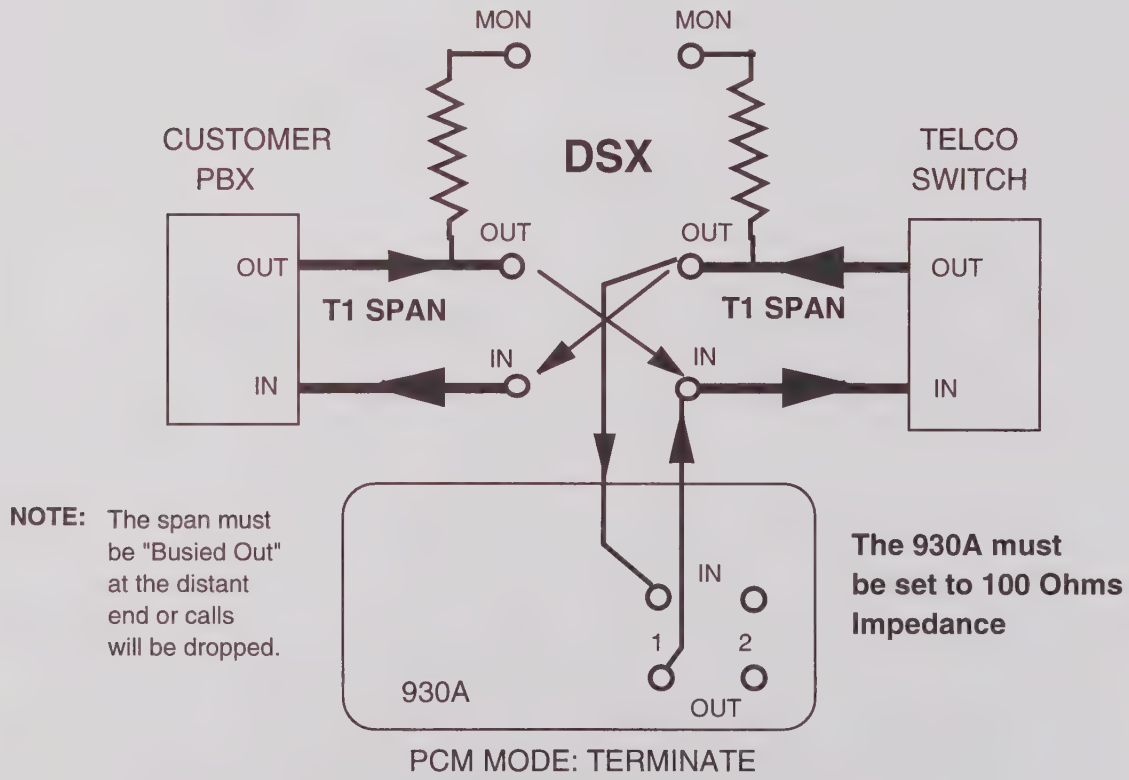


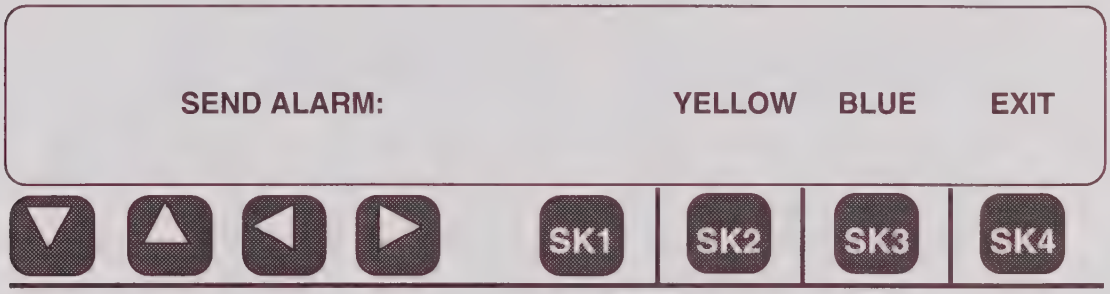
Figure 6-40
SENDING ALARMS OR FORCING SLIPS FROM THE 930A

You may try to force a frame slip toward the distant end of your circuit to see if it is loop-timed. If it is loop-timed, you will not be able to force a slip.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **40** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

6-40.1 Send Alarm

To send an Alarm, press softkey 1 or 2 to see:



Press softkey 2 to send the Remote, (**YELLOW**) Alarm (on D4 and SLC-96, bit number 2 is forced to 0 on all 24 channels; on ESF, a special code is sent over the Facility Data Link). Press softkey 3 to send the All 1s (**BLUE**) Alarm.

When you select an alarm, a cursor appears over your selection. When you exit from this menu the alarm is turned off.

6-40.2 Skew Clock

To force a slip, the 930A must be supplying the clock to the circuit (**INT CLK**). Refer to **Section 3, Function Key Operation** for Trunk Type set-up.

Press softkey 3 or 4 under **SKEW CLOCK** from the main **SELECT** menu. If the 930A is set to **INT CLK** the normal 1.544 MHz clock will be offset by 100 Hz. This is enough to force frame slips to occur if the distant end of the circuit is not Loop-Timed.

If you are not in **TERMINATE** mode or have chosen **LOOP TIME** under the **INT CLK** menu in the Trunk Type mode, you will see the message:

Press any softkey to return to the previous display. Once you are in **INTERNAL** clock mode, the display will read:

When skew is set properly and the far-end is not loop-timed, a slip will occur every 2-3 seconds.

Exiting this menu returns the 930A to the normal clock mode. Slips, if they occur, will be detected while you are in this menu and the display will be interrupted momentarily to indicate slips are occurring. The Slip Counter in Menu Option 43 will also be counting the slips.

6-41 OPTION MENU #: 41 READ T1 VOLTAGE

To measure the positive and negative base-to-peak voltages, connect one, or both, of the PCM receivers to the DSX. For example, the diagram below shows a 930A in the MON-1 mode connected to the monitor jack on a DSX.

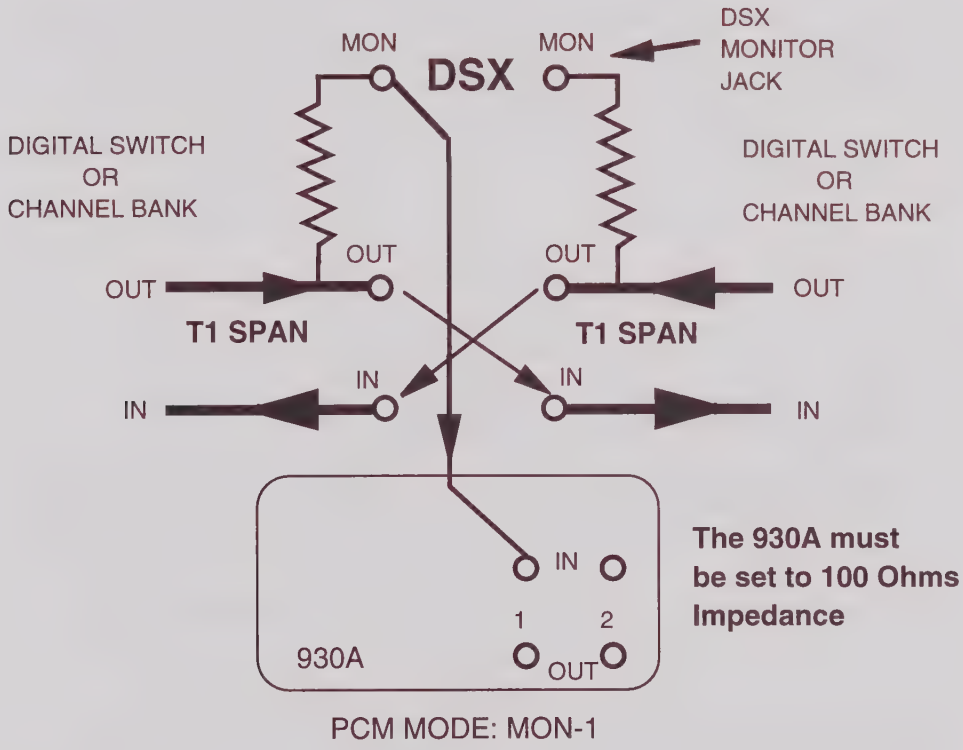
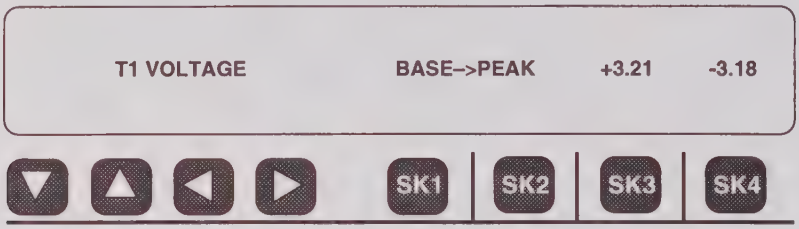


Figure 6-41
MEASURING T1 VOLTAGE AT THE DSX MONITOR JACK

At the DSX output jacks, expect to see about ±3.0 volts base-to-peak. At the monitor jacks, however, expect to see about one tenth the voltage, or roughly ±0.3 volts base-to-peak. The reading should not be less than ±0.2 volts base-to-peak at the DSX Monitor jack. If so, this indicates a possible problem on the span. It could be a problem with a repeater, a defective cable, poor equalization, or too long a cable run from the equipment to the DSX.

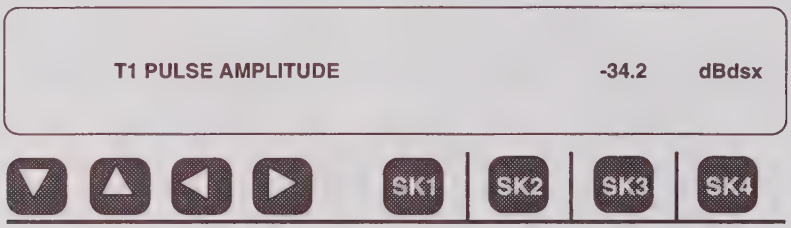
After you have set the PCM Trunk Type and connected the test cords to the DSX, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **41** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

Press any softkey to get into the main menu and the 930A will display its readings as Base-to-Peak voltage. An example of a typical reading at the DSX monitor jack is shown below:



The positive and negative going peaks are close to each other in terms of absolute value. If they were very different from each other (more than 0.5 Volt), or if they were much higher or lower than the nominal 3 Volts (±6.0 Volts), problems may occur.

To read the T1 pulse amplitude in dBdsx instead of voltage, press any softkey under the display and the display will look similar to:



3.0 Volts base-to-peak is equal to 0.0 dBdsx. Readings between -1.0 and 1.0 dBdsx would be expected at the DSX output jacks. Readings of about -20 dBdsx would be expected at the DSX monitor jacks.

6-42 OPTION MENU #: 42 T1 WANDER

T1 Wander, sometimes called Bit Slips, occurs prior to a Frame Slip. This option indicates whether or not a span may have a slip problem. The 930A best performs this test in **MON-1&2** mode to be able to compare the outgoing and incoming clocks. See **Section 5, PCM Operation** for set-up procedures.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **42** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If you have the 930A connected as shown below, you will compare the clock on the two sides of the span:

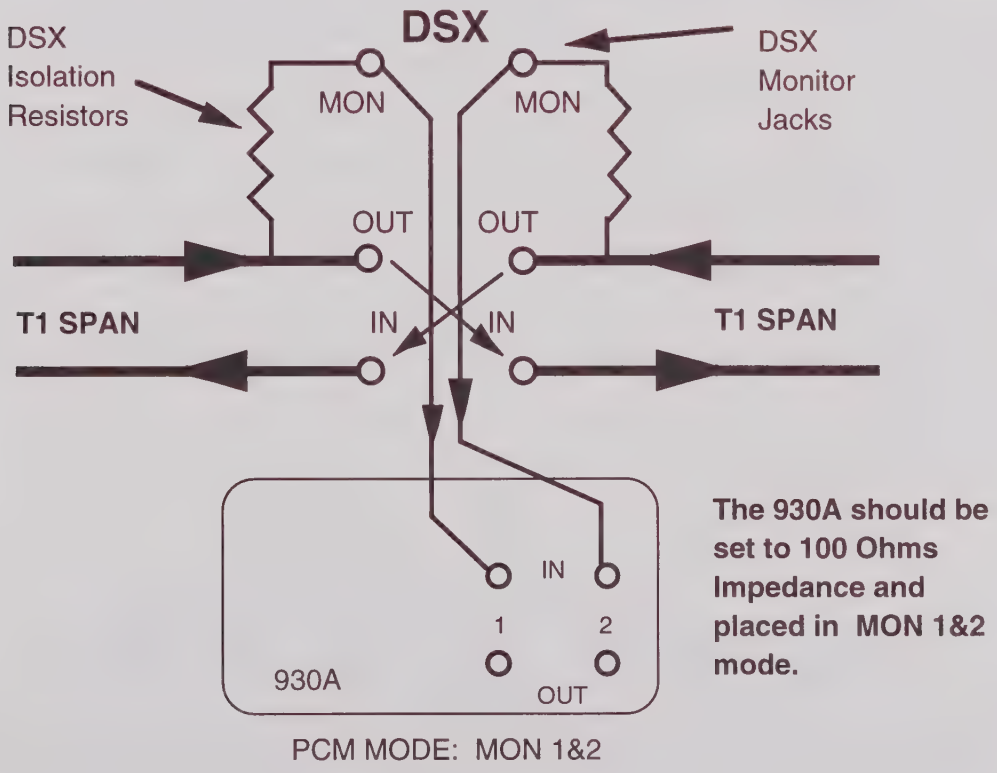


Figure 6-42
930A CONNECTED FOR WANDER MEASUREMENT

If the 930A is Loop-Timed, the display will be:

This frequency difference between bit streams is also called the Bit-Slip rate (gated rate for 1 second). 193 Bit-Slips = 1 Frame Slip.

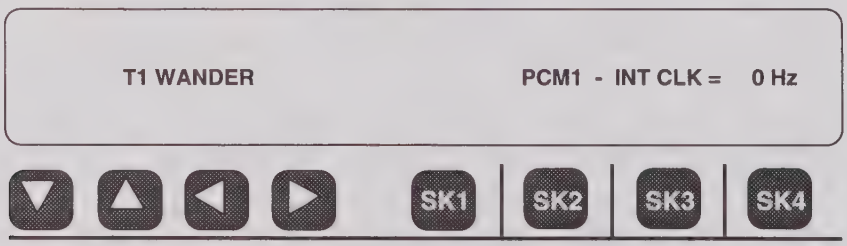
If the 930A is not Loop-Timed, you might see a display like:

In this case, bit slips will occur and the two sides may diverge until a frame slip occurs. This could be in either the + or - direction. Connect the 930A to **PCM 1 IN** and the suspect side of the span to **PCM 2 IN**. Stay connected to the DSX monitor jacks.

The 930A may also be used in the **MON-1** or **TERMINATE** modes. In this case the 930A compares the clock on **PCM IN 1** to its own internal clock.

> If the 930A is in the **TERMINATE** mode and on **EXT CLK (LOOP-TIME)**, going to this option will cause the 930A to temporarily change to **INT CLOCK**. When you exit from this menu, the 930A returns to **EXT CLK**.

A typical display of wander, when in a single direction mode is:



Do not expect PCM1 to agree with the 930A's Internal Clock, unless the far-end is Loop-Timed to the 930A. The actual value is not significant. Large changes in the readings, however, indicate that the clock in your switch, or the clock in your 930A, is wandering and needs to be repaired.

6-43 OPTION MENU #: 43 T1 ERROR COUNTERS

Once the PCM Trunk Type has been selected and connected the 930A to the T1 span, the 930A automatically monitors and counts Frame Slips, Frame Errors, Bipolar Violations (BPV), Frame Losses and CRC Errors (CRC errors apply only to the ESF mode). All measurements are in accordance with CCITT G.821. See **Section 5, PCM Operation** for set-up information.

If the 930A is not in **Option Menu #: 43**, the 930A display will momentarily interrupt what it is showing you to flash the error messages on its screen. If you are in a dual direction mode such as **MON-1&2** or **D&I**, the 930A will also show you from which direction the error came.

6-43.1 Example: MON 1&2 Mode

To demonstrate the procedure, the MON-1&2 mode example will be used. The test connection diagram is shown below:

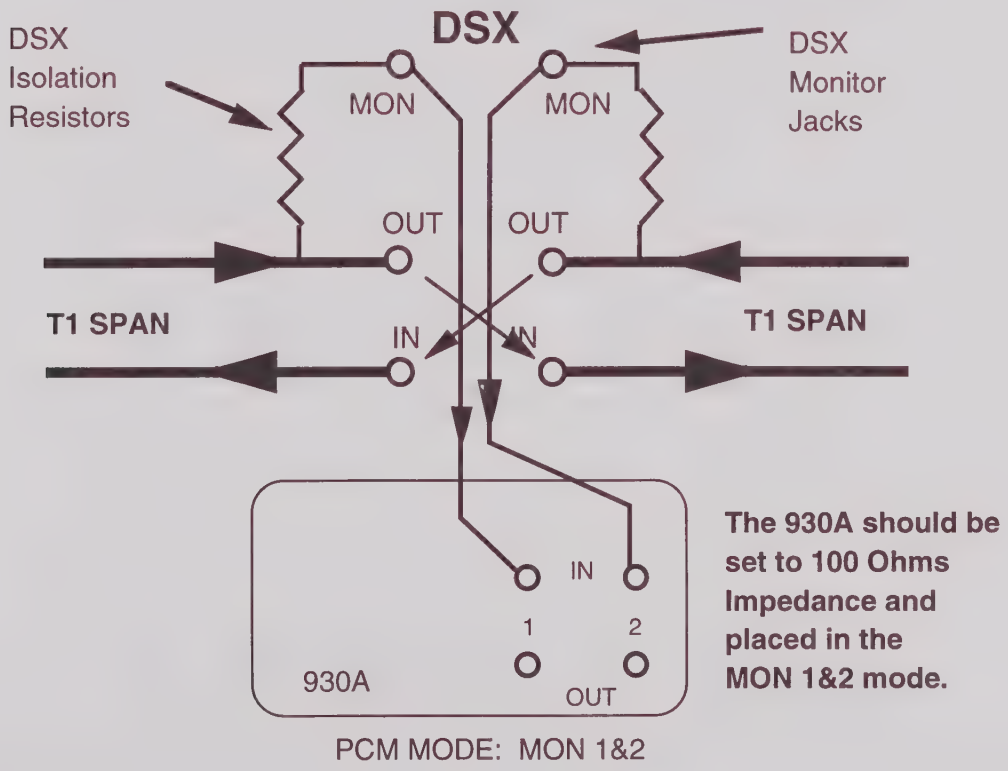
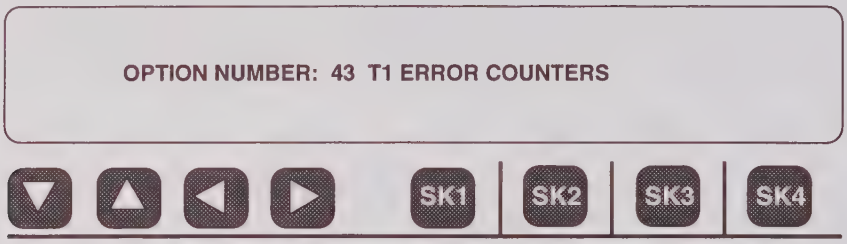


Figure 6-43
TEST CORD CONNECTIONS FOR ERROR MONITORING

When the 930A is in the **MON-1&2** mode, and connected to the DSX monitor jacks, errors will accumulate as they occur.

To view the errors after completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **43** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

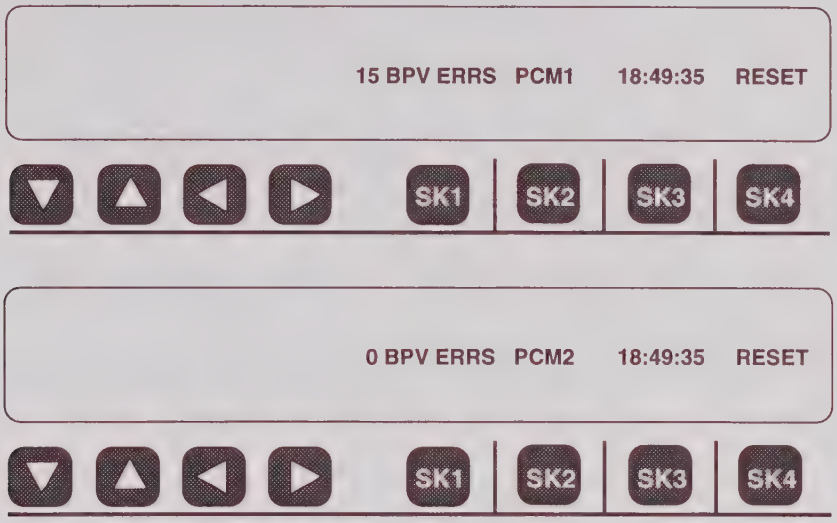


Press any softkey under the display and the current display of the error counts will be shown. In order of display, the tests are **BPV ERR, BPVR** (Bipolar Violations Rate), **FR** (Frame) **ERRS, BIT SLIP, FR SLIP, FR LOSS, NO PCM, EFS** (Error Free Seconds), **%EFS, ES** (Errored Seconds), **%ES, SES** (Severely Errored Seconds), **%SES, FAILED, %FAILED, AVAIL, %AVAIL, UNAVAIL,** and **%UNAVAIL.**

Press softkey 1 or the Up/Down arrow keys to page through the tests described above. For example, the next test displayed is:

If the 930A is in the **MON-1&2** or **D&I** modes, you can check the results on side 2. Press softkey 2 to toggle back and forth from side 1 to side 2. The 930A has independent counters on each side.

The following two displays show the results from PCM1 and PCM2:



Errors for ES and SES are based on Bipolar Violations and Frame, FPS, and CRC errors depending on the Frame type used.

Press the **CLR** key or softkey 4 under **RESET** to clear all counters. Press the **Option Menu** function key to exit.

6-44 OPTION MENU # 44: T1 ERROR HISTORY

This option requires *Purchased Option 930A-08E, Single Direstion ESF* or *-09E, Dual Drop/Insert w/ ESF*. This feature gives you up to 24 hours of history on the span under test. The tests are **BPV ERR, BPVR** (Bipolar Violations Rate), **FR** (Frame) **ERRS, BIT SLIP, FR SLIP, FR LOSS, NO PCM, EFS** (Error Free Seconds), **%EFS, ES** (Errored Seconds), **%ES, SES** (Severely Errored Seconds), **%SES, FAILED, %FAILED, AVAIL, %AVAIL, UNAVAIL,** and **%UNAVAIL.** Counts are displayed in 15-minute blocks for up to 24 hours at a time. If the 930A is connected to a printer (or a computer), the information is not limited to the last 24 hours.

6-44.1 Example: MON 1&2 Mode

As an example, suppose you have set-up your 930A to monitor both directions of transmission, as shown below:

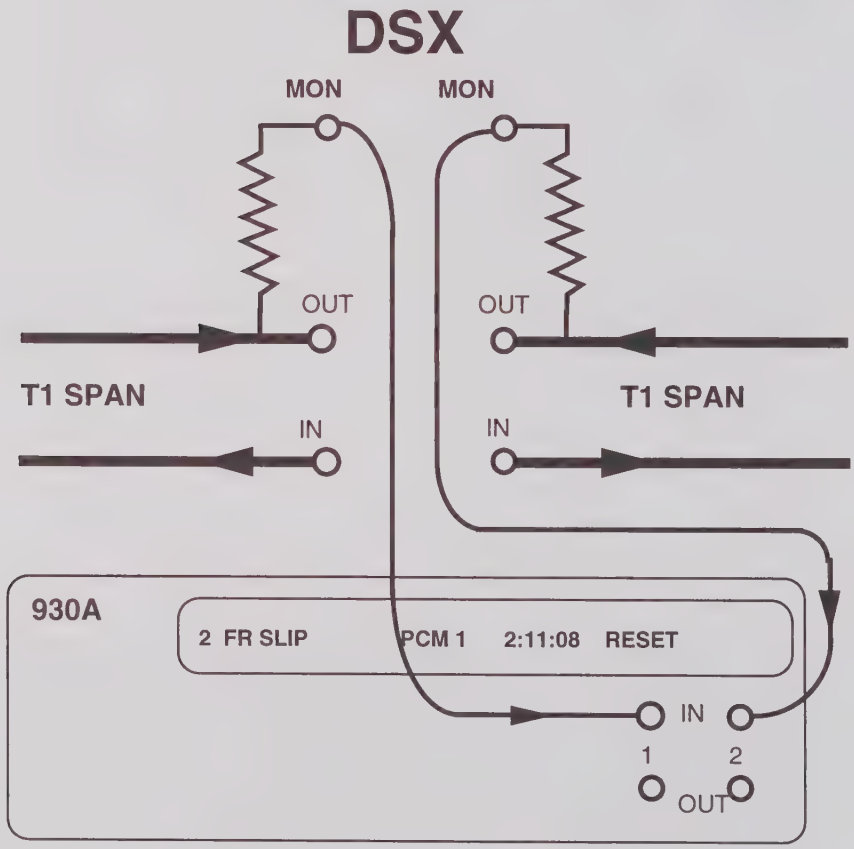


Figure 6-44
MONITORING IN BOTH DIRECTIONS

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **44** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press any of the softkeys under the display to reach the first set-up screen:

6-44.2 View

To review the errors which have occurred over the past 24 hours, press softkey 2 under **VIEW** and the history display will come up showing the latest block in which error data has accumulated. An example might look like:

The above display shows the 61st 15-minute block of time since the test began (roughly 15 hours) . To find out what has gone on over this time period, press softkey 3 under **BLK: 61**. The 930A display will begin at Block 1. Continue pressing softkey 3 to scroll through the remaining 60 blocks. Note that the time above softkey 4 changes with each block.

If the 930A is monitoring both sides of the line, press softkey 2 to toggle to **PCM2**. The same results apply as for **PCM1**.

Press softkey 1 or the Up/Down arrow keys to scroll through the remaining tests. Likewise, press softkey 2 to scroll through the remaining blocks. If you have *Purchased Option 930A-10C, Remote Control Interface* installed you may connect a printer or computer to the 930A and view the results via terminal or printout. See **Section 7, Remote Control Operation** for instructions on connecting a printer or computer to your 930A.

6-44.3 Print

The 930A must be equipped with *Purchased Option 10C, Remote Control Interface* for this feature to function accurately.

Press the **Option Menu** function key to return to the main set-up menu.

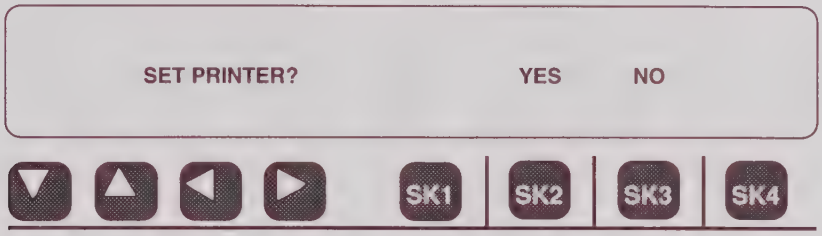
To send the results to date to a printer or terminal, press softkey 3 under **PRINT.** You will see:

Softkey 2 under **TOTAL** sends the accumulated total of errors in each block. Softkey 3 under **ALL** sends every test in every block. Press softkey 1 under **RANGE** to specify the number of blocks to print. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning number and/or softkey 2 for the ending block number. Use the numeric keypad and press **ENT** or any softkey. Press softkey 3 under **PRINT** when complete.

6-44.3.1 Not In Printer Mode

If you have not set the 930A to **PRINTER, COMPUTER** or **TERMINAL** mode (via **OPTION MENU #: 3 REMOTE CONTROL**) you will see a brief message **NOT IN PRINTER MODE!** and then the display:



Press softkey 3 under **NO** to discontinue the set-up procedure. You will be returned to the previous screen.

To set the parameters for your printer, press softkey 2 under **YES** to advance to the **REMOTE MODE** display:

Press softkey 2 under **OFF** to scroll through the available remote options. Press softkey 3 under **SET-UP** to set the baud rate, parity and bit #. Refer to **Section 6-3 REMOTE CONTROL** for set-up instructions.

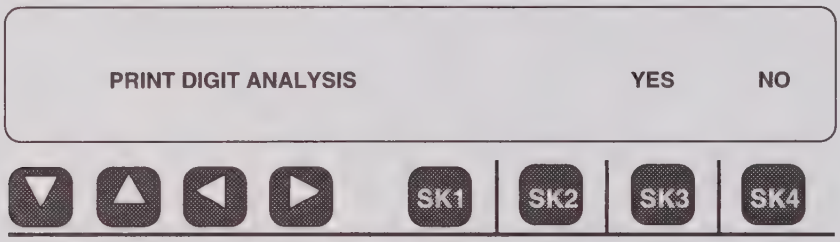
After completing the **SET-UP**, press softkey 4 under **EXIT**. The 930A will advance to a series of questions regarding printing parameters. To bypass these displays, press the **Option Menu** function key to return to the main **PRINT** menu.

If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT ERRORS**?

To send PCM errors, press softkey 3 under **YES**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:

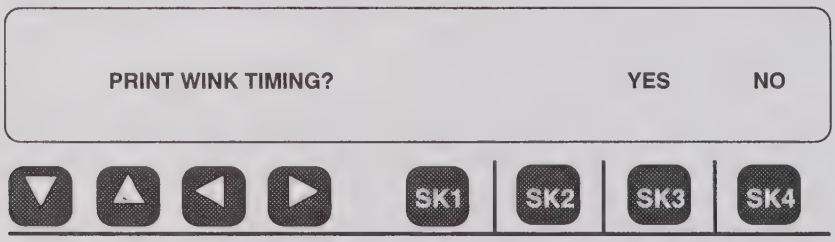
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT RECEIVED RECORDS**?

To send calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4. Selecting **YES** displays the following screen. Selecting **NO** skips the following screen:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT DIGIT ANALYSIS**?

To send the analysis of the received digits, press softkey 3 under **YES**, otherwise press softkey 4. The 930A display advances to:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT ERRORS**?

To send the wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A will exit the Option Menu. The printer will begin to print whenever one of the conditions occurs, or whenever the **ENT** key on the 930A is pressed.

Press the **ENT** key to test your connection. If the output is garbled, adjust the baud rate, parity, or number of bits. To suspend printing for any reason without taking the 930A out of Printer mode, turn off the printer.

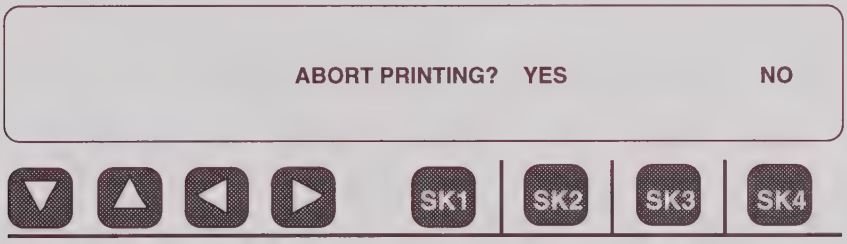
Taking the printer off-line instead of turning off the power may not have the desired effect. The printer buffer may fill up with unwanted material which will be printed out when the printer is placed back on-line.

You will be returned to the **PRINT** menu:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be printed. If you press softkey 3 under **ALL**, every test in every block will be printed. Press softkey 1 under **RANGE** to specify the number of blocks you wish to print. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be printed. Press softkey 3 under **PRINT** when complete.

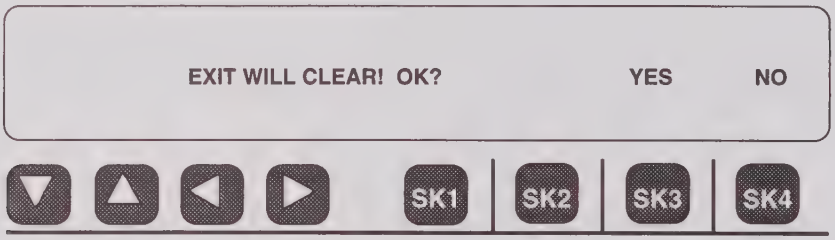
To abort printing, press any softkey or the **Option Menu** function key to see the screen below.



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:

Press softkey 3 under **TOTAL** to send the accumulated total of errors in each block. Press softkey 4 under **ALL** to send every test in every block. Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:



Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-45 OPTION MENU #: 45 T1 ERROR INJECT

This option requires *Purchased Option 930A-08E, Single Direction ESF or -09E, Dual Drop/Insert w/ESF*. T1 Error Inject allows you to inject a single BPV, Frame Error or CRC Error. This feature is only active when the 930A Trunk Type has been set to either the **TERMINATE** or **D&I** mode. Errors cannot be injected when the 930A is monitoring the T1 facility. Refer to **Section 5, PCM Operation** for set-up information.

A typical connection of the 930A when operating in the **TERMINATE** mode (simulating a channel bank) is shown below:

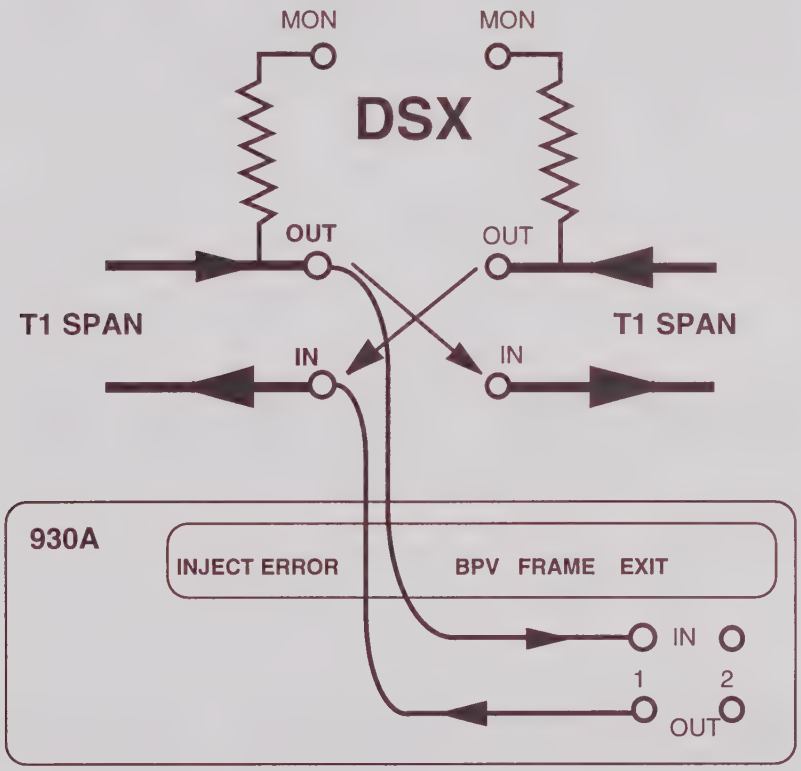
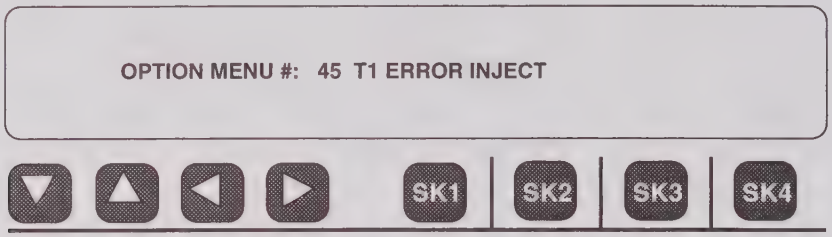


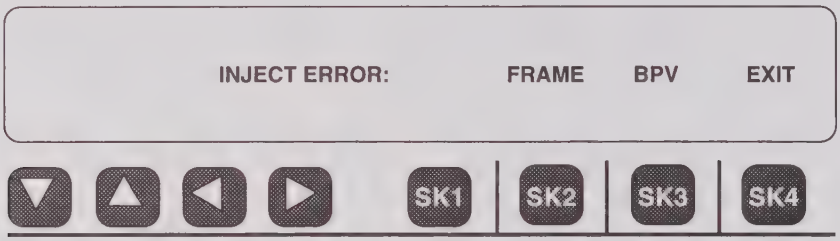
Figure 6-45.1
INJECTING ERRORS WITH THE 930A

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **45** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

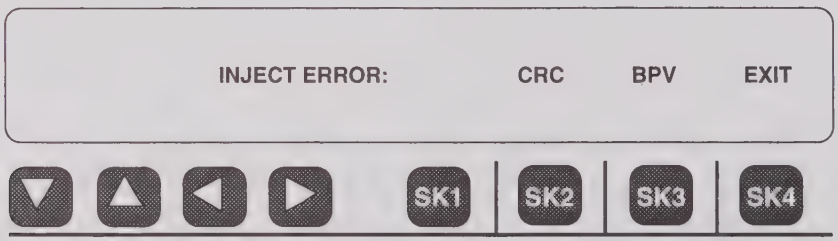


Press **ENT** or any softkey under the display to enter the option. The next display to appear depends upon whether the 930A has been set for **D4/SF** (Superframe) or **ESF** (Extended Superframe) operation. The displays are shown below.

The display for **D4/SF** is:



The display for **ESF** is:



To inject an error, press the softkey beneath the type of error you want the 930A to send. To inject a Bipolar Violation, press softkey 3 under **BPV**. To inject a **FRAME** error in D4/SF, or a **CRC** error in ESF, press softkey 2.

The display will momentarily flash a cursor over the error being injected. If you are testing on a looped back facility, the 930A will record the error coming back. The display will flash the appropriate error and the error counter in **OPTION MENU #: 43 T1 ERROR HISTORY** will increment. See **Section 6-43** for instructions how to use Error History.

6-46 OPTION MENU #: 46 DS-1 BIT ERROR RATE

This option requires *Purchased Option 930A-08E, Single Direction ESF or -09E, Dual Drop/Insert w/ESF.* If *Purchased Option 930A-08E* is installed, the 930A has single direction Bit Error Rate (BER) testing capability. If *Purchased Option 930A-09E* is installed, the 930A performs as the equivalent of two BER test sets.

6-46.1 Introduction

Take the T1 out of service prior to any testing. Connect test cords from the 930A to the T1 under test (DSX or CSU jack access points). Regardless of what Trunk Type the 930A was in previously, upon entering **OPTION MENU #: 46 DS-1 BIT ERROR RATE**, the 930A automatically sets to T1 operation. The factory default parameter settings have been implemented to allow testing in most instances without changing any set-ups. Diagrams of test cord connections are provided on the following pages:

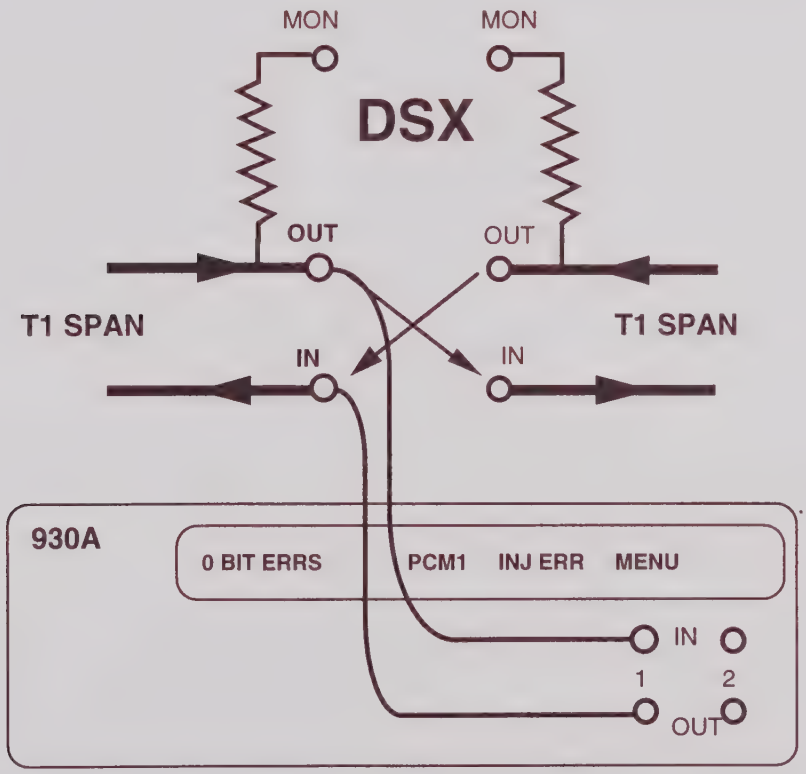


Figure 6-46.1
TEST CORD CONNECTIONS FOR SINGLE DIRECTION BERT

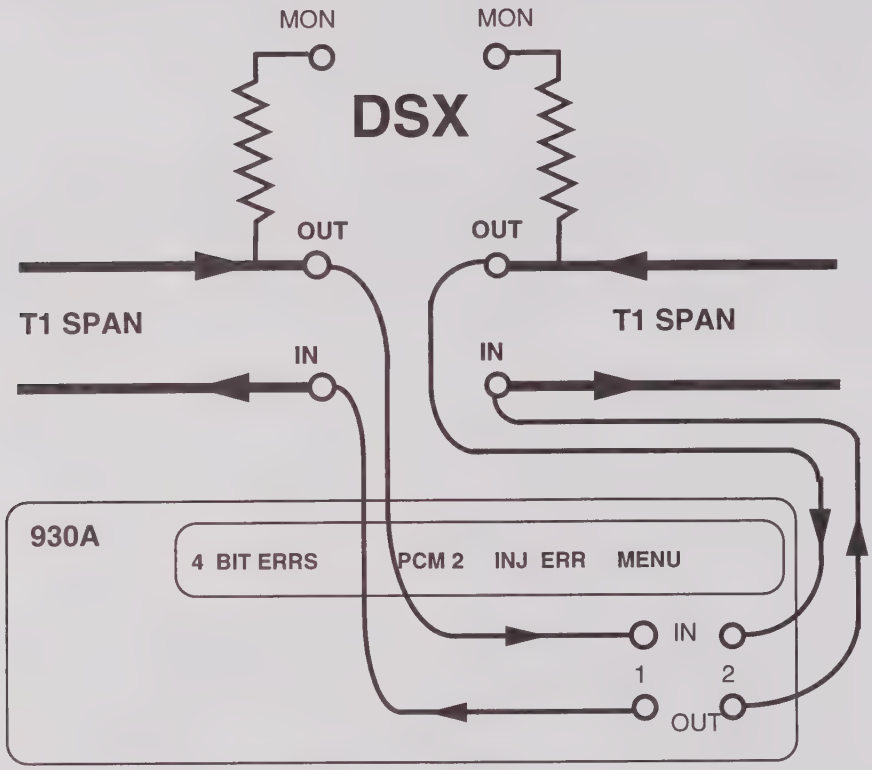
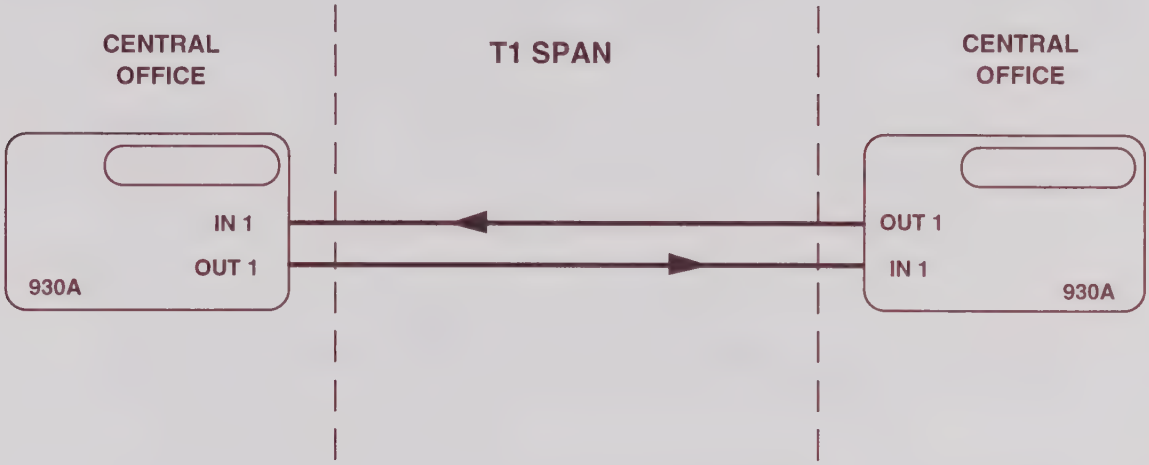


Figure 6-46.2
TEST CORD CONNECTIONS FOR DUAL-DIRECTION BERT



To do a BER test using the above set-up, connect the test cords accordingly. Both units must be set to the same patterns and parameters to achieve sync.

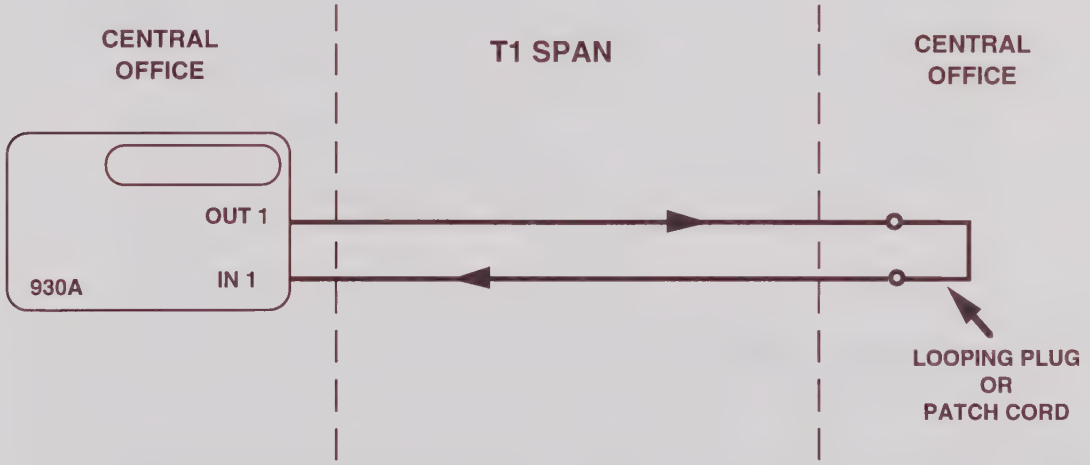


Figure 6-46.3
TEST SET-UP WITH FAR END LOOPED BACK

Use the factory defaults for testing if the far-end is looped back.

When testing on a T1 facility that terminates into a T1 Channel Service Unit (CSU) on a customers premises, the 930A can send the **LOOP-UP** code toward the CSU. This causes the CSU to loop the T1 back toward you. The test cord connection is shown below:

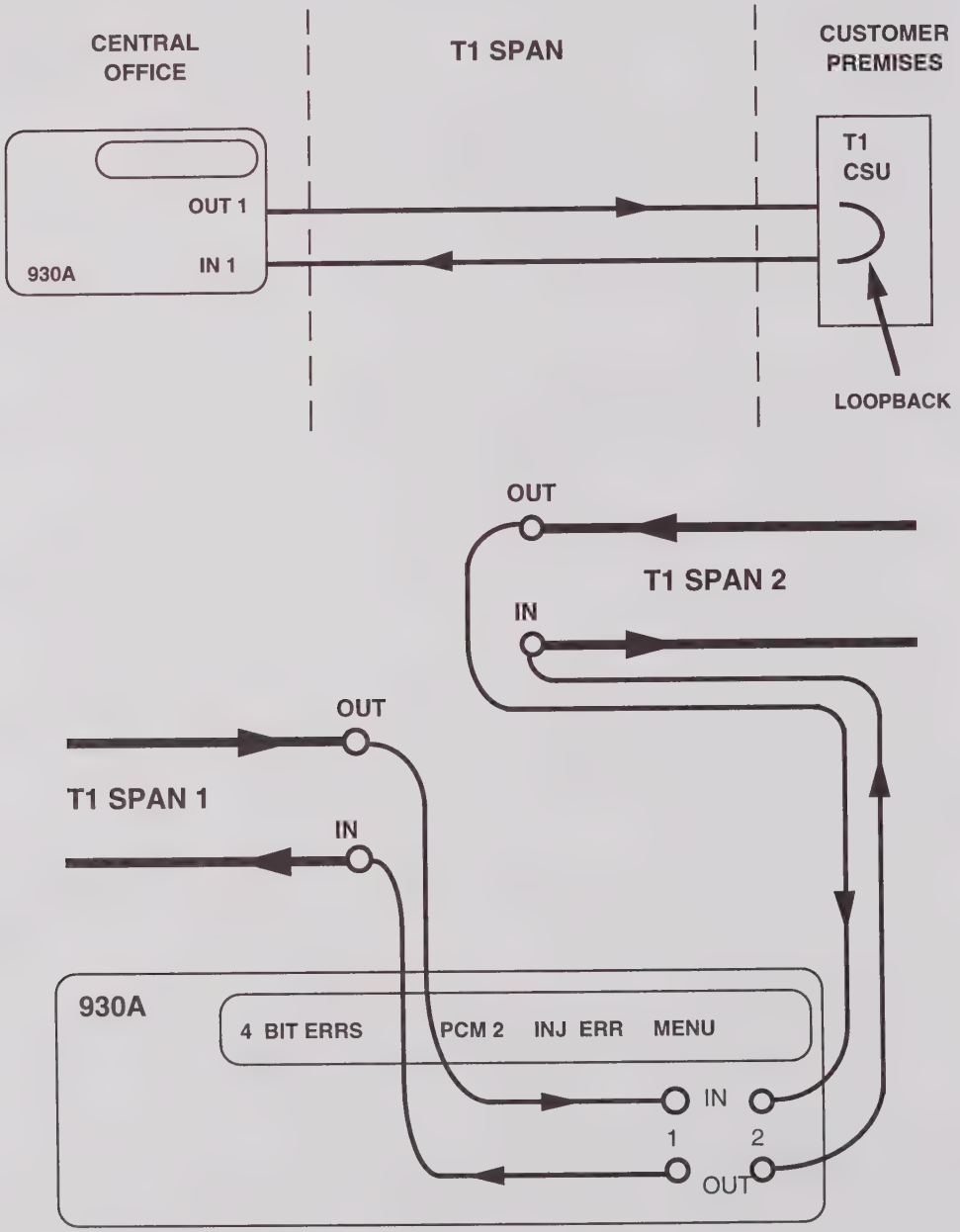


Figure 6-46.4
TWO T1 SPANS BEING BER TESTED SIMULTANEOUSLY

The above connection is used to test two separate T1 spans.

To perform a BER test toward both offices simultaneously, use the connection shown in the diagram below when between the two offices:

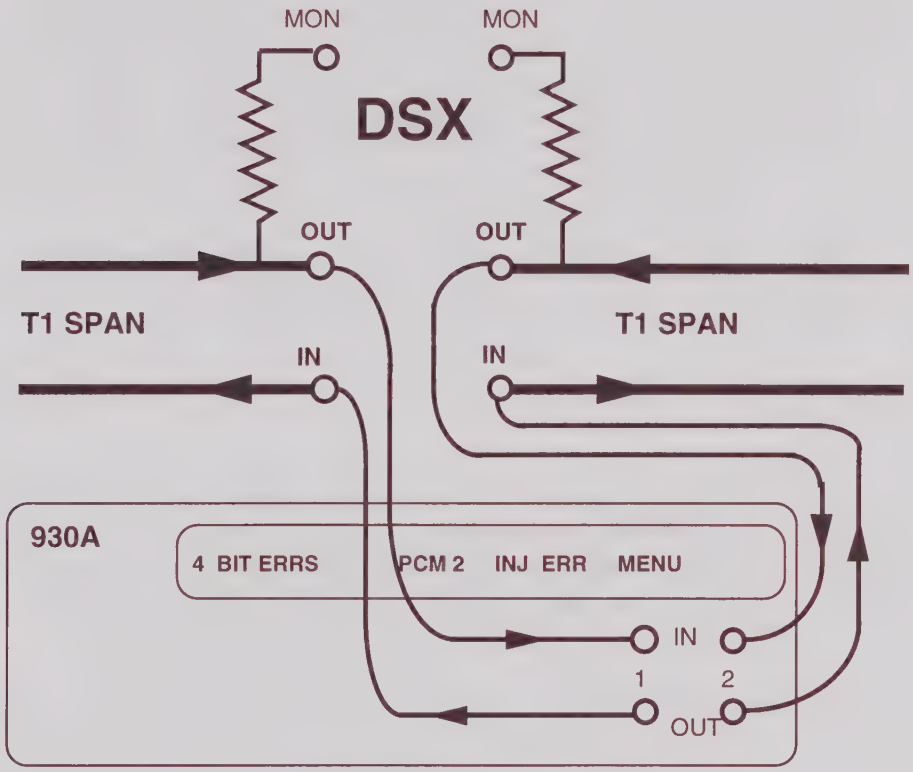


Figure 6-46.5
BETWEEN TWO OFFICES, SIMULTANEOUSLY BER TESTING TOWARD BOTH OFFICES

Be sure the T1 span you are connected to is out-of-service before you enter Menu 46!

6-46.2 DS-1 Set-up

If your 930A is equipped with *Purchased Option 930A-08E*, only single direction BERT capability is available.

If your 930A is equipped with *Purchased Option 930A-09E*, your 930A is capable of performing a single direction BERT, BERT in both directions, or BERT on separate spans.

With *Purchased Option 930A-09E* installed, both side 1 and side 2 of the 930A are always activated upon entering **Option Menu #: 46.** Either side may be viewed during a test.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **`OPTION MENU #`**. Press the Up/Down arrow keys to scroll through the option menus, or select **`46`** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If the 930A is not in PCM mode, the display will momentarily read **`SETTING T-1 MODE...STAND BY`**. If this is the case, select the Trunk Type function key and place the 930A in PCM mode. Refer to **Section 5, PCM Operation** for more information.

Once the 930A is in PCM mode, the following screen will display:

The following are the default parameters for testing in this option:

```
Pattern:          QRSS
Frame:            D4 Superframe
Clock:            Internal 1.544 Mbps ±30 bps
Impedance:        100 Ohms
Line Coding:      AMI
Test Length:      Continuous
```

To test using these parameters, skip to **Section 6-46.3 Test Mode**. The following sections describes the **`SET-UP`** procedure for parameters other than the default parameters shown above.

6-46.2.1 Customizing Parameters

Be sure the T1 span you are connected to is out-of-service before you enter Option Menu 46!

To check or change the test parameters, press softkey 1 under **SET-UP** to see:

The default test pattern is **QRSS** and the default framing is **D4/SF**. To change the test pattern, press the Up/Down arrow keys or softkey 1 under **QRSS** to scroll through the available tests. The following tests are in order of appearance on the 930A:

QRSS	Quasi-Random Word
USER	User definable pattern up to 24 bits long
1:1	Alternating 1 and 0 pattern
1:7	A 1 followed by seven 0's (also 1 in 8 pattern)
3 in 24	Three 1's in 24 bits (a stress pattern)
ALL 1's	All ones pattern (Blue Alarm)
LONG-PAT	A special 440 bit long stress pattern
2↑23	A pseudo-random sequence 8 megabits long
2↑20	A pseudo-random sequence 1 megabit long
2↑15	A pseudo-random sequence 32 kilobits long
2047	A pseudo-random sequence 2047 bits long
511	A pseudo-random sequence 511 bits long

Refer to **Section 6-46.2.3** for the **USER** pattern set-up procedure. The following instructions are for all other tests.

Press softkey 3 to scroll through the Frame types **D4/SF, ESF** or **UNFRAMED**.

Press softkey 4 under **MORE** to see:

To change clock source, press softkey 1 or 2 under **LOOP-TIME** or softkey 3 or 4 under **INTERNAL** as appropriate. The default is **INTERNAL.** In this case the 930A supplies the 1.544 Mbps clock. The display will advance to:

Press softkey 1 or 2 to select **100 OHM** impedance or softkey 3 or 4 for **>1K OHM**. The display will advance to:

Press softkey 1 or 2 to select **AMI** (Alternate Mark Inversion) or softkey 3 or 4 to for **B8ZS** (Bipolar 8 Zero Substitution) line coding. The display will advance to:

The default **TEST LENGTH** is **CONTINUOUS.** In this case the 930A will perform the test until manually disabled. Use the Up/Down arrow keys or press softkey 2 to scroll through the valid parameters. Following **CONTINUOUS** is **15 MINUTES**, **1 HOUR**, and **24 HOURS**. Press softkey 4 to return to the main menu.

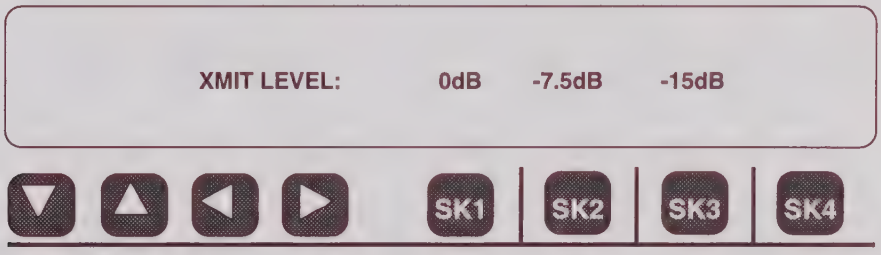
If your 930A is equipped with *Purchased Option 930A-44, CSU Emulation* the following section describes more set-up procedures. If *Purchased Option 930A-44* is not installed, please skip to **Section 6-46.2.2**.

> *You do not have to run through all of the set-ups just to change one parameter. Press the **Option Menu** function key after you have made the necessary change(s) to leave the submenu levels.*

6-46.2.2 CSU Submenus

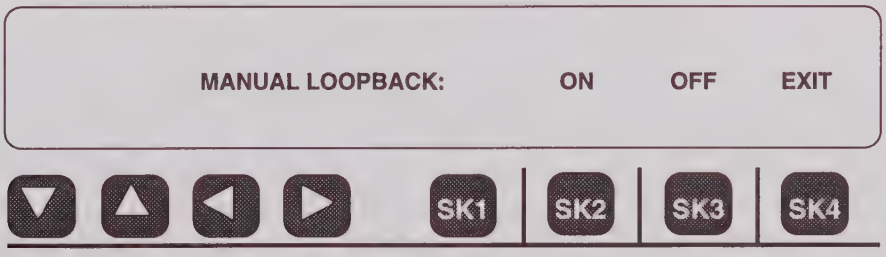
The following submenus are available with a 930A equipped with *Purchased Option 930A-44, CSU Emulation*. For instructions on CSU Emulation, see **Section 6-48, CSU Emulation**.

From the previous submenu (**TEST LENGTH**), press softkey 4 under **EXIT** to see:



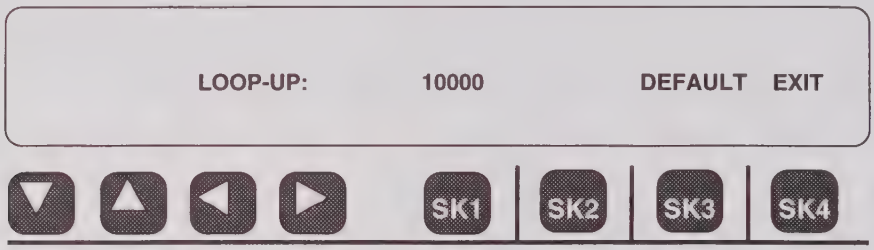
Press softkey 1 to select **0 dB,** softkey 2 to select **-7.5 dB** or softkey 3 to select **-15 dB.** The display will advance to:

Press softkey 3 under **MANUAL** to manually enable loopback. You will see:



Press softkey 2 for **ON** or softkey 3 for **OFF**. Press softkey 4 under **EXIT** to return to the previous screen.

Press softkey 1 under **AUTO** for automatic selection. Press softkey 2 under **NOTIFY** for the 930A to indicate an alarm condition. After selecting either **AUTO** or **NOTIFY**, the 930A display becomes:



The default loop-up code is **10000**. Press the **CLR** key to delete any existing pattern. Enter the desired pattern (up to 8 bits in length) using the **1** and **0** keys on the numeric keypad. To edit the pattern, use the Left/Right arrow keys to position the cursor over the digit you want to change and enter a **1** or **0** from the keypad. This function *types over* the digit under the cursor. The Up arrow key *inserts* a **0** digit directly to the right of the cursor. This function moves all digits to the right for the corresponding number of insertions. The Down arrow key deletes the digit directly to the right of the cursor. Press softkey 4 under **EXIT** when complete.

To return to the default code, press softkey 3 under **DEFAULT**. Press softkey 4 under **EXIT** when complete. The display will change to:

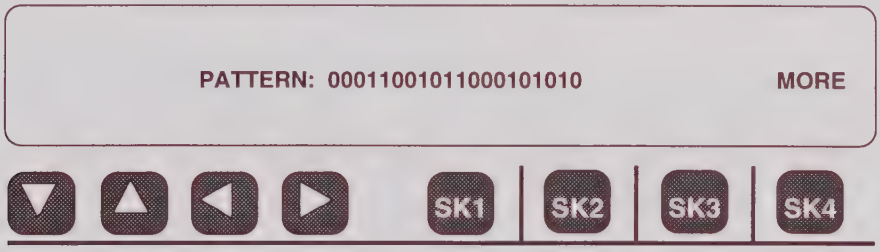
The default loop-down code is **100**. Press the **CLR** key to delete any existing pattern. Enter the desired pattern (up to 8 bits in length) using the **1** and **0** keys on the numeric keypad. To edit the pattern, use the Left/Right arrow keys to position the cursor over the digit you want to change and enter a **1** or **0** from the keypad. This function *types over* the digit under the cursor. The Up arrow key *inserts* a **0** digit directly to the right of the cursor. This function moves all digits to the right for the corresponding number of insertions. The Down arrow key deletes the digit directly to the right of the cursor. Press softkey 4 under **EXIT** when complete.

To return to the default code, press softkey 3 under **DEFAULT**. Press softkey 4 under **EXIT** when complete. You will return to the **SELECT** menu.

6-46.2.3 The USER Pattern

To access the **USER** pattern, press the Up arrow or softkey 1 under **QRSS** from the main **SET-UP** menu. The following display appears:

Press softkey 4 under **MORE** to display the **USER** pattern. The following is an example pattern:



Press the **CLR** key to delete any existing pattern. Enter the desired pattern (up to 24 bits in length) using the **1** and **0** keys on the numeric keypad. To edit the pattern, use the Left/Right arrow keys to position the cursor over the digit you want to change and enter a **1** or **0** from the keypad. This function *types over* the digit under the cursor. The Up arrow key *inserts* a **0** digit directly to the right of the cursor. This function moves all digits to the right for the corresponding number of insertions. The Down arrow key deletes the digit directly to the right of the cursor.

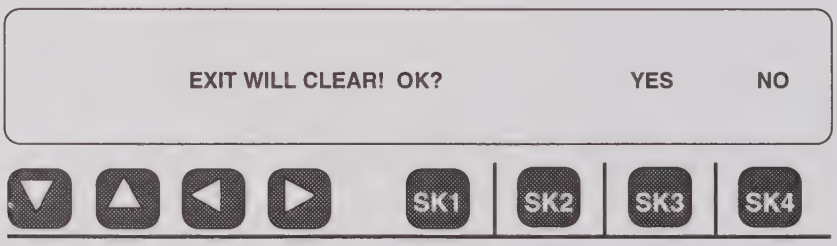
> *The pattern entered becomes the test pattern the 930A will use in the **TEST** menu. By using the 930A's **STO** (store) and **RCL** (recall) functions the 930A can store up to 39 different **USER** patterns.*

6-46.3 Test Mode

After completing the set-up procedure, press softkey 2 under **TEST**. If you have not made any connections or your test cords are not connected correctly, you will see a **NO PATTERN SYNC** indication in the display. Otherwise, the test results will be displayed above softkey 1 in the following screen:

Press softkey 2 under **PCM1** to toggle between sides. If side 2 is not connected, you will see **NO PCM**. If side 2 is connected, the test results for **PCM2** will be displayed above softkey 1. Use softkey 1 or the Up/Down arrow keys to scroll through the available tests.

Press the **Option Menu** function key to exit this display. You will be returned to the previous submenu. Testing will continue until you press softkey 4 under **EXIT**. You will see:



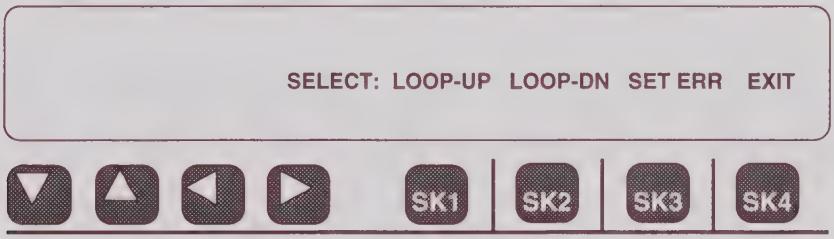
Press softkey 4 under **NO** to continue testing and softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

If you do not interrupt the test, the message **TEST COMPLETED** will display if a finite parameter was selected under the **TEST LENGTH** menu (**15 MINUTES, 1 HOUR, 24 HOURS**).

6-46.3.1 Testing Toward A T1 CSU

After completing the set-up procedure, press softkey 2 under **TEST**. When testing toward a CSU, you will see the following display:

NO PATTERN SYNC will be displayed. You must loopback the CSU by sending it the loop-up code for approximately 5 seconds. To loop the CSU, press softkey 4 under **MENU**. You will see:



Press softkey 1 under **LOOP-UP** to see:

The default loop-up code is **10000**. Press the **CLR** key to delete any existing pattern. Enter the desired pattern (up to 8 bits in length) using the **1** and **0** keys on the numeric keypad. To edit the pattern, use the Left/Right arrow keys to position the cursor over the digit you want to change and enter a **1** or **0** from the keypad. This function *types over* the digit under the cursor. The Up arrow key *inserts* a **0** digit directly to the right of the cursor. This function moves all digits to the right for the corresponding number of insertions. The Down arrow key deletes the digit directly to the right of the cursor.

To return to the default code, press softkey 3 under **DEFAULT**.

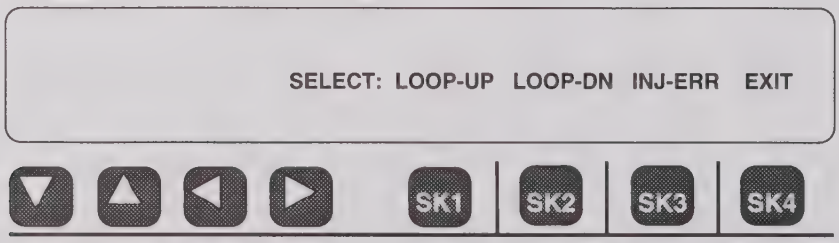
To send the loop-up code, press softkey 2 under **SEND**. The 930A display will show:

When the loop-up is completed, the 930A will display **REMOTE LOOP UP ESTABLISHED**. If the loop-up is not successful the display will read **REMOTE LOOP UP UN-SUCCESSFUL** and the 930A will return to the main BERT screen.

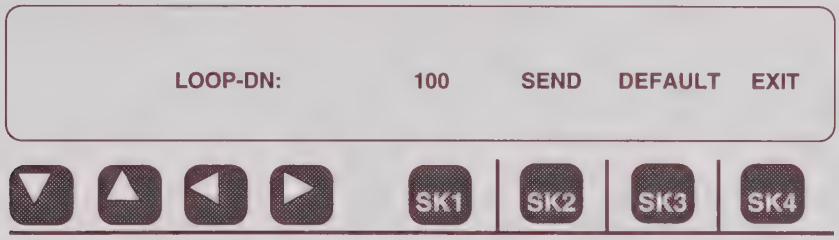
If loop-up was successful and errors are detected, the 930A will display error indications above softkey 1. If you do not see any errors within 15 minutes (scroll through all the error counters using softkey 1 or the Up/Down arrow keys), the span is probably working. If the problem is intermittent, run the test for at least 24 hours. Return to **Section 6-46.1** for information on the 930A's **TEST LENGTH**. To test the integrity of the loop, press softkey 3 under **INJ ERR** (inject error) once and the 930A display should change to:

Press the **CLR** key to zero the counters.

After your testing is complete, press softkey 4 under **MENU** to return to the **SELECT** menu.

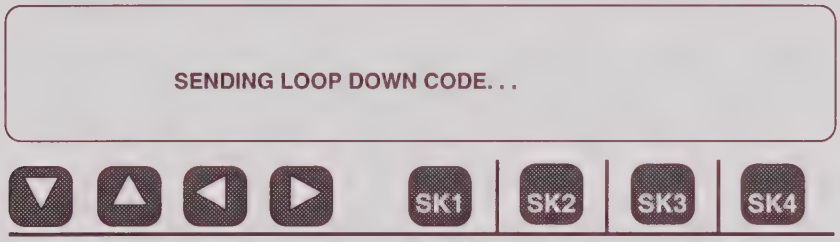


Press softkey 2 under **LOOP-DN** and the display will change to:



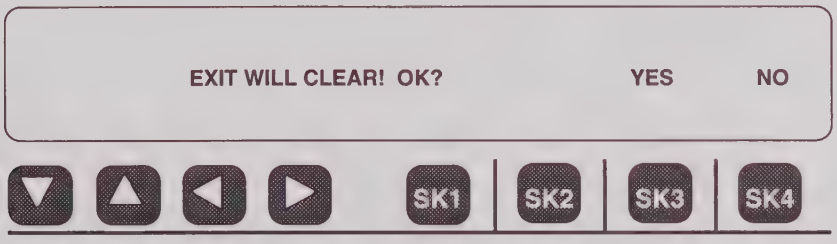
The default loop-down code is **100**. Press the **CLR** key to delete any existing pattern. Enter the desired pattern (up to 8 bits in length) using the **1** and **0** keys on the numeric keypad. To edit the pattern, use the Left/Right arrow keys to position the cursor over the digit you want to change and enter a **1** or **0** from the keypad. This function *types over* the digit under the cursor. The Up arrow key *inserts* a **0** digit directly to the right of the cursor. This function moves all digits to the right for the corresponding number of insertions. The Down arrow key deletes the digit directly to the right of the cursor.

Press softkey 2 under **SEND** to restore the CSU to normal operation. You will see:



When the Loop has been taken down, the 930A will display **REMOTE LOOP DOWN SUCCESSFUL**. You will return to the main BERT display:

Press the **Option Menu** function key to exit this display. You will be returned to the previous submenu. Testing will continue until you press softkey 4 under **EXIT**. You will see:



Press softkey 4 under **NO** to continue testing and softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-46.4 BER Testing Two T1 Spans Simultaneously

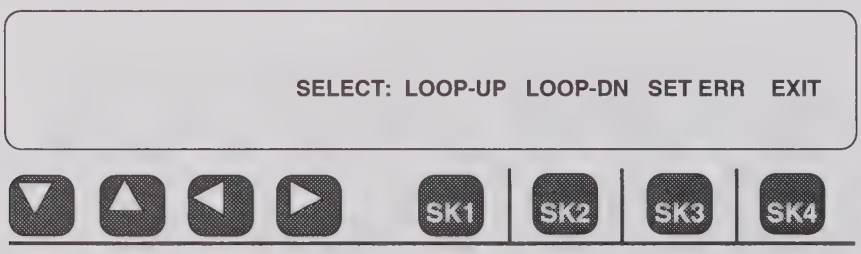
Your 930A has the functionality of two BERT sets if it is equipped with *Purchased Options 930A-09E* and *930A-22* . Connect the jacks labeled **PCM 1 IN/OUT** and test one span while you connect **PCM 2 IN/OUT** to another span. Press the softkey under **TEST**. Press softkey 2 under **PCM1** to toggle between looking at the errors on Side 1 and those on Side 2. See **Figure 6-18** for the connection set-up.

The **HISTORY** for both sides is accumulated. Press softkey 2 to toggle between Side 1 and Side 2 results.

6-46.5 Injecting Errors

Press softkey 2 under **TEST**. You will see the display:

Press softkey 4 under **MENU** to change the type of errors being injected:



Press softkey 3 under **SET ERR.**

There are three possible displays depending upon whether you have chosen D4/Superframe, ESF or Unframed operation:

D4/Superframe

ESF

Unframed

Press the softkey directly beneath the type of error you want to send. The 930A display returns to the main BERT menu.

Any error counters are lost if you leave Option Menu #: 46.

6-46.6 History

To review the errors which have been recorded, press softkey 3 under **HISTORY**. If no tests have been made, you will see the message **NO BERT HISTORY AVAILABLE**. Otherwise, you will see:

6-46.6.1 View

Press softkey 2 under **VIEW** and the history display will come up showing the latest block in which error data has accumulated. An example might look like:

The above display shows the 61st 15-minute block of time since the test began (roughly 15 hours). To find out what has gone on over this time period, press softkey 3 under **BLK: 61**. The 930A display will begin at Block 1. Continue pressing softkey 3 to scroll through the remaining 60 blocks. Note that the time above softkey 4 changes with each block.

If you are monitoring both sides of the line, pressing softkey 2 will toggle to **PCM2**. The same results apply as for **PCM1**. Press softkey 1 or the Up/Down arrow keys to scroll through the remaining tests. Press the **Option Menu** function key to return to the **SELECT** menu.

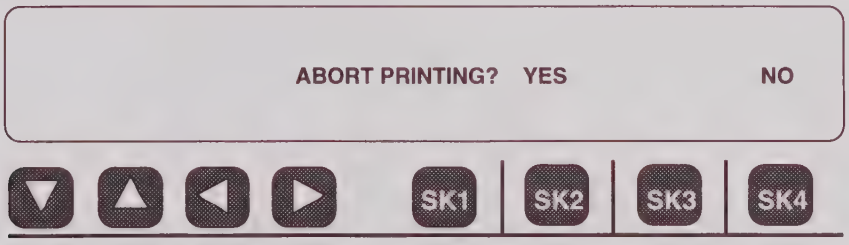
6-46.6.2 Print

If *Purchased Option 930A-10C, Remote Control Interface* is installed, you may connect a printer or computer to the 930A and view the results via terminal or printout. See **Section 7, Remote Control Operation** for instructions on connecting a printer or computer to your 930A. To send out the results to date, press softkey 3 under **HISTORY**. Press softkey 3 again under **PRINT.** You will see:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be sent. If you press softkey 3 under **ALL**, every test in every block will be sent. Press softkey 1 under **RANGE** to specify the number of blocks you wish to send. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

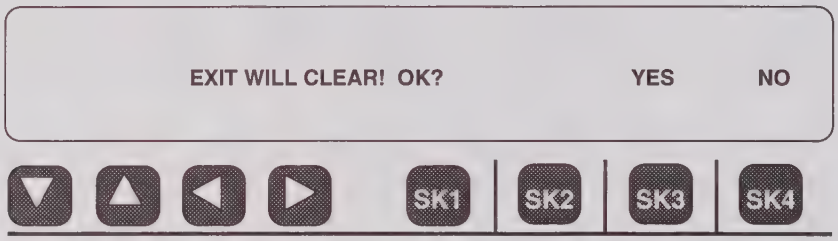
To abort printing, press any softkey or the Option Menu function key to see the screen below:



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:

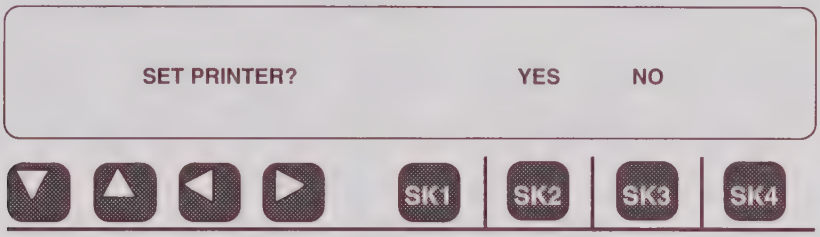
Press softkey 4 to exit this menu or the Option Menu function key to return to the top level menu. You will see:



Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

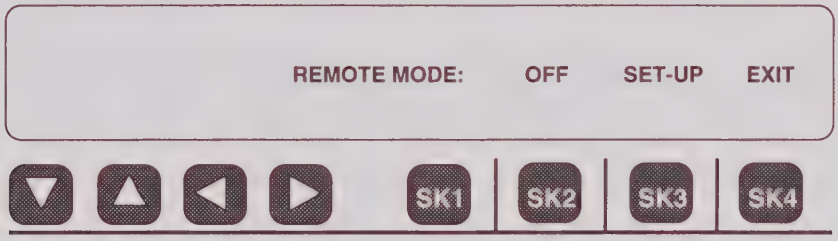
6-46.6.2.1 Not In Printer Mode

If you have not set the 930A to **PRINTER, COMPUTER** or **TERMINAL** mode (via **OPTION MENU #: 3 REMOTE CONTROL**), you will see a brief message **NOT IN PRINTER MODE!** and then the display:



Press softkey 3 under **NO** to discontinue the set-up procedure. You will be returned to the previous screen.

To set the parameters for your printer, press softkey 2 under **YES** to advance to the **REMOTE MODE** display:



Press softkey 2 under **OFF** to scroll through the available remote options. Press softkey 3 under **SET-UP** to set the baud rate, parity and bit #. Refer to **Section 6-3, Remote Control** for set-up instructions.

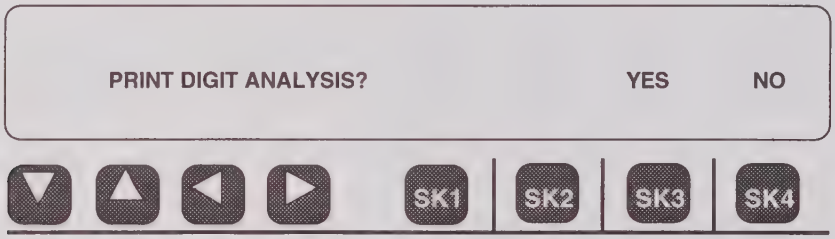
After completing the **SET-UP**, press softkey 4 under **EXIT**. The 930A will advance to a series of questions regarding printing parameters. To bypass these displays, press the **Option Menu** function key to return to the main **PRINT** menu.

If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT ERRORS**?

To send PCM errors, press softkey 3 under **YES**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:

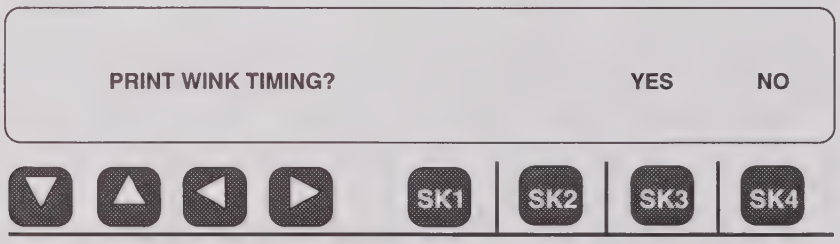
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT RECEIVED RECORDS**?

To send calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4. Selecting **YES** displays the following screen. Selecting **NO** skips the following screen:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT DIGIT ANALYSIS**?

To send the analysis of the received digits, press softkey 3 under **YES**, otherwise press softkey 4. The 930A display advances to:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT WINK TIMING**?

To send the wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A will exit the Option Menu. The printer will begin to print whenever one of the conditions occurs, or whenever the **ENT** key on the 930A is pressed.

Press the **ENT** key to test your connection. If the output is garbled, adjust the baud rate, parity, or number of bits. To suspend printing for any reason without taking the 930A out of Printer mode, turn off the printer.

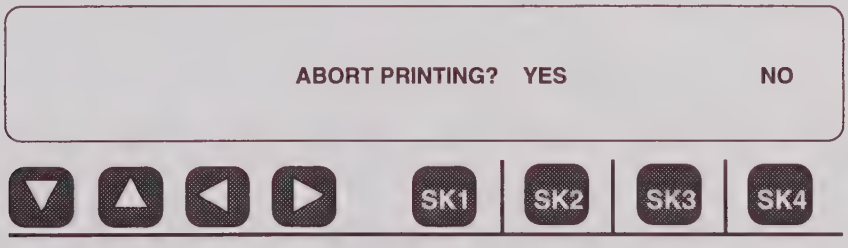
> *Taking the printer off-line instead of turning off the power may not have the desired effect. The printer buffer may fill up with unwanted material which will be printed out when the printer is placed back on-line.*

You will be returned to the **PRINT** menu:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be printed. If you press softkey 3 under **ALL**, every test in every block will be printed. Press softkey 1 under **RANGE** to specify the number of blocks you wish to print. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

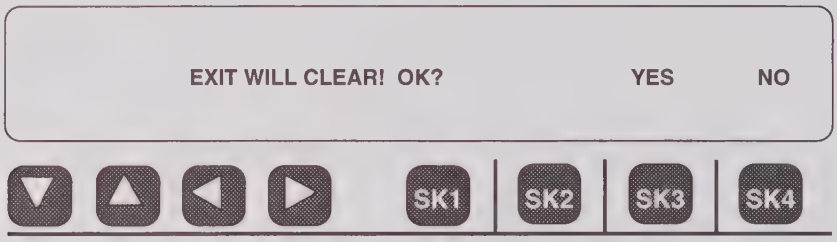
To abort printing, press any softkey or the **Option Menu** function key to see the screen below.



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:

Press softkey 3 under **TOTAL** to send the accumulated total of errors in each block. Press softkey 4 under **ALL** to send every test in every block. Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:

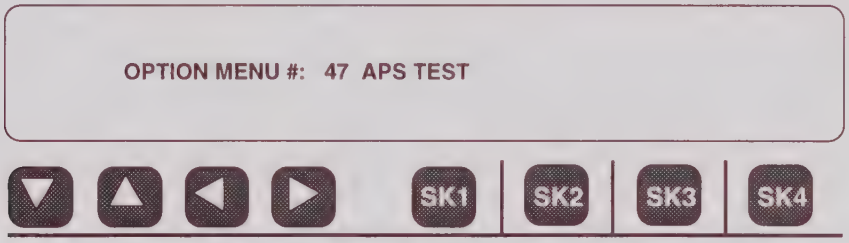


Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-47 OPTION MENU #: 47 APS TEST

This **Option Menu #** requires *Purchased Option 930A-08E, Single Direction ESF* or *-09E, Dual Drop/Insert w/ESF.* This function is used to test a T1 Automatic Protection Switch's ability to sense an error rate in excess of its threshold and switch to the standby T1 span. The test consists of sending a BPV rate slightly below the switch's error threshold for 20 seconds to check for false triggering, then sending a BPV rate slightly above the threshold for 20 seconds to make sure that the protection switching is activated, and lastly, a BPV rate of 1/10 the initial rate is sent to make sure the switch restores the span to normal operation.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **47** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

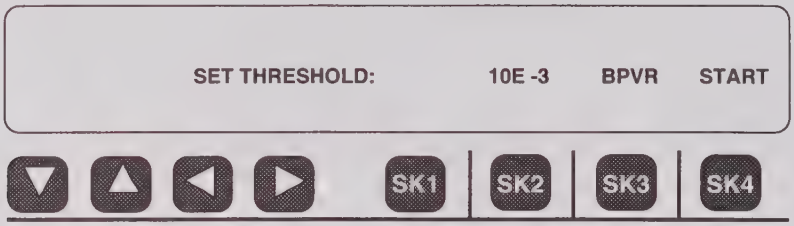


Press any softkey and you will get to the main selection menu:

Use softkey 1 to select a multiplier of **0.9**, **1.0** or **1.1**. Use softkey 2 to scroll through exponent rates of **10E-3**, **10E-4**, **10E-5** or **10E-6**.

After setting the desired BPV rate, press softkey 3 under **SEND** and the 930A will begin injecting errors at the selected rate. The cursor above **SEND** will flash indicating the function was selected. Press softkey 3 again to discontinue sending.

To perform an automatic protection switch test, press softkey 4 above **APS TEST**. Select the desired APS threshold:

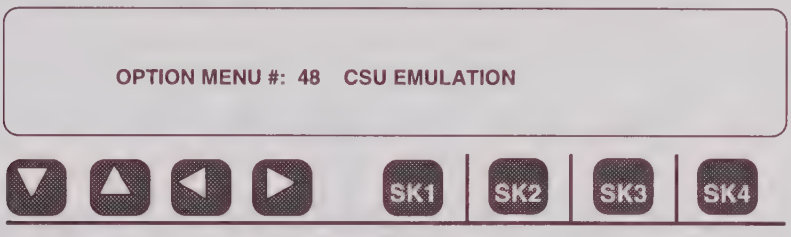


Press softkey 2 to scroll through the available exponents. The valid rates are **10E-3**, **10E-4** or **10E-5**. Press softkey 4 under **START** to begin the APS test. The 930A will send BPVs at a rate slightly below the selected threshold for 20 seconds, and then send at a rate slightly above the threshold for 20 seconds. The 930A will send at a rate of one tenth the initial error rate to see that the switch returns to its normal state.

After pressing softkey 4 under **START**, you will see a display similar to:

The seconds are counted down from **20** on the counter above softkey 3. The test may be terminated at any time by pressing softkey 4 under **EXIT**. When the test is finished, the 930A returns to the test menu. Press the **Option Menu** function key to exit the option.

6-48 OPTION MENU #: 48 CSU EMULATION



This Option Menu number requires *Purchased Option 930A-44, CSU Emulation* which adds the special line interface functions necessary to connect directly to a T1 span.

The four major functions provided by the CSU Emulation option are listed below:

1) Automatic line build-out (ALBO) circuit to adapt to the levels and frequency response of long spans.

2) Selectable transmit line build-out with an output attenuation of 0 dB, 7.5 dB, or 15 dB.

3) A Simplex current path between the **IN** and **OUT** jacks with a current measurement function.

4) Remote loopback functions, allowing the 930A to respond to in-band loopback codes and perform a line loopback function.

Only the PCM1 interface is equipped with the CSU Emulator; the Special CSU functions are intended for use only in the **TERMINATE** mode.

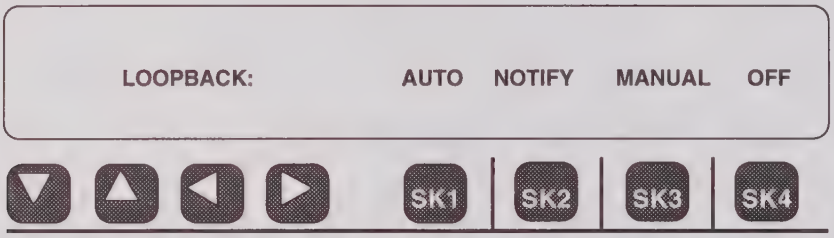
After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **48** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If the 930A is not in PCM mode, the following screen will display:

Press the **Trunk Type** function key and select **PCM**. See **Section 3, Function Key Operation** and **Section 5, PCM Operation** for set-up information.

After your set-up is complete, press the **Option Menu** function key and return to **Option Menu # 48.** The following screen is displayed:

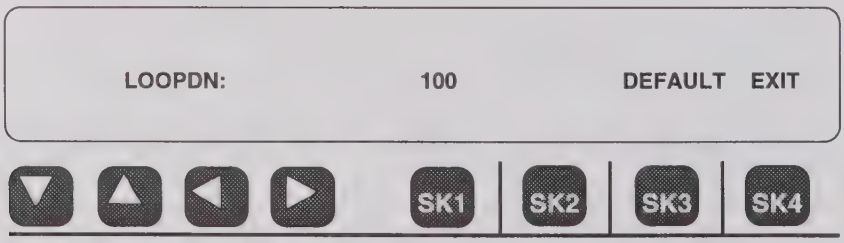
6-48.1 DS-1 Loopback

For configuring and setting DS-1 Loopback, press softkey 1 under **DS1 LPBACK**.



To set the Loopback for automatic selection, press **AUTO**. You will see the following display:

The default **LOOP UP** parameter is **10000**, however, up to 8 bits are available. To change the parameter, enter the new **LOOP UP** code from the keypad. Press **EXIT** when complete. The display will change to:



The default **LOOP DN** parameter is **100**, however up to 8 bits are available. To change the parameter, enter the new **LOOP DN** code from the keypad. Press **EXIT** when complete. You will return to the first set-up menu. The **AUTO LOOPBACK** is now set. The loopback will occur on the next loop-up command from the network.

You may also set-up a **MANUAL** loopback which will loop on command. After selecting **DS1 LPBACK**, press softkey 3 under **MANUAL**. You will see:

Press softkey 2 or 3 to select **ON** or **OFF** to command the CSU loopback on or off. Press softkey 4 to **EXIT** back to the **LOOPBACK** menu.

In **NOTIFY** mode, a message is displayed when a loop command is received and the 930A is not in Option Menu #: 48. If the loop code has been detected for at least five seconds, the display will read **CSU LOOP UP REQUEST** or **CSU LOOP DOWN REQUEST** until the loop code is sent. After being notified, the 930A must be manually placed into loopback.

To turn the manual loopback off, press softkey 4 under **OFF**. The display returns to the first set-up menu.

6-48.2 Line Build-Out

To select the line Build-Out setting, press softkey 2 under **LBO**.

The LBO is set for the design criteria furnished, or based on the number of feet away from the first repeater. The maximum distance is 2500 feet. Press softkey 1 for the default parameter of **0 dB,** softkey 2 for **-7.5 dB** or softkey 3 for **-15 dB.** After pressing the proper Build-Out setting, the 930A will return to the set-up screen.

6-48.3 Current

Measure the current on the T1 facility by selecting **CURRENT**. An example may look like:

This screen indicates that there is .075 mA of current on the span simplex. Press **EXIT** to return to the first set-up menu.

6-48.4 Input

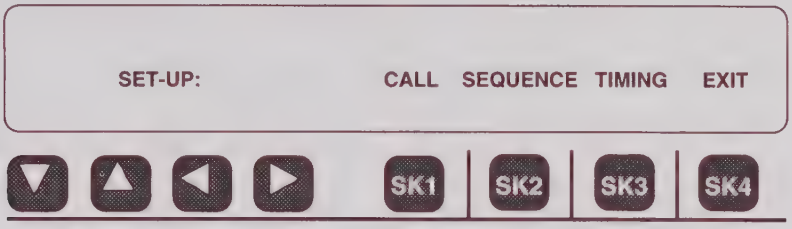
The CSU Emulation feature will also work with **DSX** or **SPAN** terminations. Low level signals can still be monitored when required. To change the required T1 interface, press softkey 4 under **INPUT**. You will see:

Press softkey 2 under **DSX** to monitor a T1 span. Press softkey 3 under **SPAN** for termination on a T1 span. The 930A will return to the main menu. Press the **Option Menu** function key to exit the option.

6-49 THIS PAGE INTENTIONALLY LEFT BLANK

6-50.3 Set-up

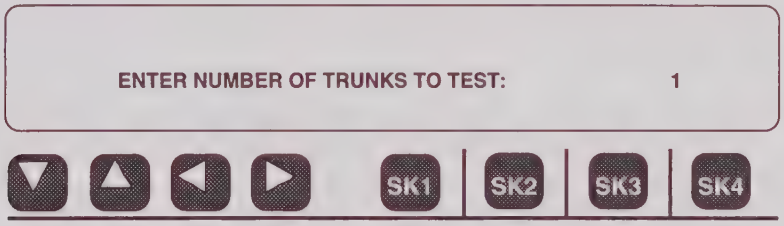
Press softkey 1 under **SET-UP**.



6-50.3.1 Call Sequence

> *Before setting up the sequence in* ***BATCH MODE****, use the* ***Dial/Ring*** *function key to enter the telephone number into the 930A. Press the* ***STO*** *key to store it into a memory location. Refer to* ***Section 6-50.1*** *and* ***Section 3, Function Key Operation*** *for more information.*

To set-up the call sequence, press softkey 1 or 2 under **CALL SEQUENCE.** You will be prompted:



If the current parameter displayed is appropriate, press any softkey to proceed. To enter a different number of calls, use the numeric keypad. The valid range is from **1** to **998** trunks. Press the **ENT** key. The display will advance to the next set-up screen:

Softkey 2 is labeled **ROLL ->** and scrolls to the next item in the call sequence. The choices are **WINK, OFF-HK, DELAY, PAUSE, FIXED #, BATCH, TESTLINE** or **DIALTONE**. The Up/Down arrow keys can also be used to scroll through the choices.

Press softkey 3 to enter the displayed call sequence. A character representing the event will be added to the sequence and displayed on the left half of the screen. **W**=WINK, **H**=OFF-HK, **D**=DELAY, **–**=PAUSE, **F**[#]=FIXED #, **B**[#]=BATCH, **t**[#]=TESTLINE. After any selection is entered, **WINK** will reappear over softkey 3. You must start over and scroll through the list for each consecutive choice. A full sequence might look like:

6-50.3.1.1 Wink, Off Hook and Delay

A **W** causes the 930A to wait for a wink from the far-end before proceeding. The length of the wink will be recorded in **OPTION MENU # 9: WINK TIMING**. See **Section 6-9** for set-up information. If no test line is specified at the end of the call sequence, the wink timing information will also be recorded in **OPTION MENU # 51: TEST RESULTS**.

An **H** causes the 930A to wait for the far-end to go off-hook before proceeding. The length of time spent waiting for the off-hook and the length of the off-hook (up to 200 milliseconds) will be recorded in **OPTION MENU # 9: WINK TIMING**. Refer to **Section 6-9** for set-up information. If no test line is specified at the end of the call sequence, this information will be recorded in **OPTION MENU # 51: TEST RESULTS**.

An **D** causes the 930A to wait for the far-end to provide a delay dial event before proceeding. The length of time spent waiting for the event and the length of the event will be recorded in **OPTION MENU # 9: WINK TIMING**. If no test line is specified at the end of the call sequence, this information will also be recorded in **OPTION MENU # 51: TEST RESULTS**.

A [—] causes the 930A to pause for one second before proceeding.

6-50 OPTION MENU #: 50 BATCH MODE

Batch Mode enables the 930A to place multiple calls automatically, beginning at a scheduled time, and store the results of these calls in memory. The "results" may be call disposition, such as busy or reorder, wink timing, or measurements made to a remote test line (such as a 105 responder).

Purchased Option 930A-10C, Remote Control Interface is required.

Purchased Option 930A-32, 64K RAM is strongly recommended but is not required for Batch Mode. Batch operations can very quickly use up the 39 memory locations that are standard with the 930A. The 64K RAM expansion gives the 930A up to 998 memory locations, depending on the amount of information. Storing functions which take large amounts of memory reduces the overall amount of storage locations.

Batch Mode can be set-up manually, but it is generally more useful under remote control. With this option, a single computer can program several 930As to perform automated tests over a network simultaneously. Manual use of Batch Mode is helpful for repetitive tasks such as placing numerous calls to the same test line or placing calls at odd hours.

6-50.1 Introduction

Enter the telephone numbers (using the **Dial/Ring** function key) that will be called in Batch Mode and store them into the 930As memory locations. Refer to **Section 3, Function Key Operation** for the **Dial/Ring** set-up procedure.

The call sequence in **OPTION MENU #: 50 BATCH MODE** tells the 930A how many calls to place, where the telephone numbers are stored and where to store the test results. It also tells the 930A when to pause for dial tone, winks, or other supervision and whether a test line will answer the call.

For example, to place 50 calls to the same test line, store the telephone number of the test line in 930A memory, program batch mode for 50 calls to a fixed number, and give the memory location in which you had stored the test line's telephone number.

The 930A can outpulse a different telephone number for every call made in Batch mode, provided that these numbers have been stored into sequential memory locations in the 930A. This is called a batch of telephone numbers. The 930A will query for the memory location of the first number. The 930A will then dial the number stored in that memory location when it places the first call in Batch mode. On the second call, the number stored in the next register location will be dialed. The 930A will continue to increment the memory location for every call it places in Batch mode.

6-50.1.1 Batch Mode Application Examples

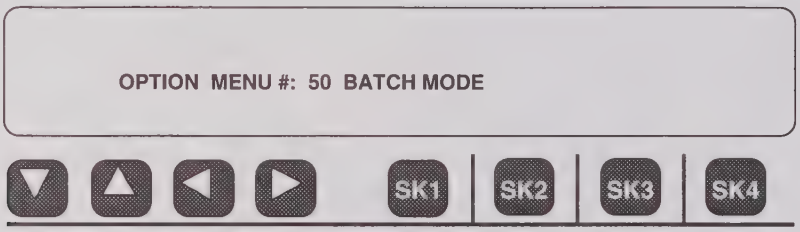
If, for example, you wanted to test 10 different circuits, each could be accessed by dialing a specific sequence of digits into your test port. Store the access digits for the first circuit into a 930A memory location, such as location 1, then store the digits for the second circuit in register 2 and so on.

You can mix batches of changing and unchanging (fixed) telephone numbers in a single call sequence. You may program the 930A to expect a test line to answer the call or to expect a 100, 102, 105 or 125 test line. A type 100 test line provides quiet termination for noise measurements. A 102 test line provides milliwatt tone either continuously or intermittently. A 105 test line is a CAROT compatible responder which includes the Sage Instruments 356E Voice/Data Responder or a second 930A acting as a far-end responder. A 125 test line is an HLI type 115 or 125 transponder and is not CAROT compatible.

The tests to be performed will depend upon the type of test line selected. When testing to a type 100 test line, the 930A can measure C-Message Noise or 3 kHz Noise. When testing to a type 102 test line you can measure one-way Loss, C-Notch Noise, and Signal-to-Noise Ratio. These tests are selected in **`OPTION MENU #: 29 CALL 102 LINE`**. Refer to **Section 6-29** for more information.

When testing to a standard 105 test line, the 930A can test two-way Loss, Gain/Slope, C-Message and C-Notch noise, and/or return loss (ERL, SRL and/or SRH). If the responder is a Sage Instruments 356E, the 930A can additionally test two-way Attenuation Distortion, Signal-to-Noise Ratio, 3 kHz Flat Noise, P/AR, Intermodulation Distortion, Phase and Amplitude Jitter (4 to 300 Hz), Envelope Delay Distortion, and/or Impulse Noise and Hits. These tests are selected through **`OPTION MENU #: 26 ROTL/RESPONDER`**. Refer to **Section 6-26** for more information.

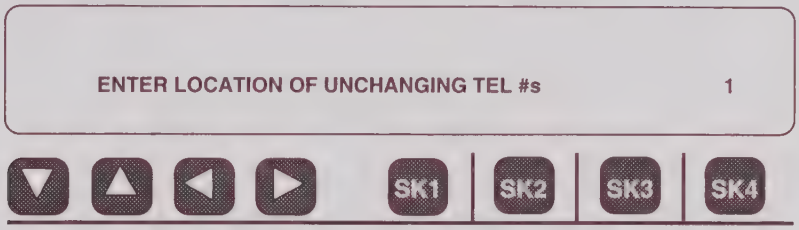
6-50.2 Operation



After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **`OPTION MENU #`**. Press the Up/Down arrow keys to scroll through the option menus, or select **`50`** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

6-50.3.1.2 Fixed

Selecting **FIXED #** from the **CALL SEQUENCE** menu will display:



Use the numeric keypad to enter the number of the memory location where the telephone number is stored. Press the **ENT** key. The letter **F** followed by a **1, 2, 3,** or **4** will be inserted into the call sequence. The 930A can have up to four fixed numbers in a call sequence.

An **F** causes the 930A to recall a telephone number stored in memory and dial it. The same number will be recalled and dialed each time.

6-50.3.1.3 Batch

Selecting **BATCH** from the **CALL SEQUENCE** menu will display:

Use the numeric keypad to enter the number of the memory location where the first telephone number is stored. Press the **ENT** key. The letter **B** followed by a **1, 2, 3,** or **4** will be inserted into the call sequence.

A **B** causes the 930A to recall a telephone number stored in memory and dial it. The memory location will be incriminated each time the 930A places a call. The telephone numbers must be stored in sequential memory locations beginning at the **STARTING LOCATION** the 930A was prompted for. There must be as many numbers stored as were programmed to test in **BATCH MODE.** For example, if **4** is the **NUMBER OF TRUNKS TO TEST**, and **1** is the **STARTING LOCATION OF TEL #s**, the 930A must have numbers stored into locations **1, 2, 3** and **4**. You may use up to four batches in a sequence.

If your 930A is not equipped with *Purchased Option 930A-32, 64K RAM Expansion*, only 39 memory locations are available. This is the maximum number of sequential telephone numbers the 930A can store. *Purchased Option 930A-32* expands this number to 998.

6-50.3.1.4 Testline

Selecting **TESTLINE** will display :

To select type **102, 105** or **125** test line, press softkey 2, 3 or 4. The characters **T2, T5** or **T1** respectively will be inserted into the call sequence. If you select **NO-TPT**, the display will show **t5.**

A **T** causes the 930A to expect a test line to answer the telephone. If the **T** is followed by a **2**, the 930A expects a type **102** test line (milliwatt). If the **T** is followed by a **5**, the 930A expects a type **105** test line. If the **T** is followed by a **1**, the 930A expects a type 115 or 125 HLI transponder. A lowercase **t5** tells the 930A to expect no Test Progress Tone.

For the specified lines, the 930A will wait for the characteristic test progress tone. If it detects busy, reorder, dial-tone or some other continuous tone, it will record the network response time and call completion status and proceed with the next call. If the expected tone is not received within 60 seconds, the current status of the line will be recorded (dead line, ringing -- no answer or speech) and the 930A will proceed with the next call.

If the 930A receives the expected tone within 60 seconds, it will record the call completion time (from the end of the last event to receipt of the test tone) and perform any selected tests.

Tests to type 102 lines are selected in **OPTION MENU # 29: CALL 102 LINE**. Tests to type 105 test lines are selected in **OPTION MENU # 26: ROTL/RESPONDER**. Refer to **Section 6-26** for information on what types of tests may be performed. Tests to type 125 lines are no longer available in the 930A.

The same set of tests will be performed on each trunk tested in Batch mode.

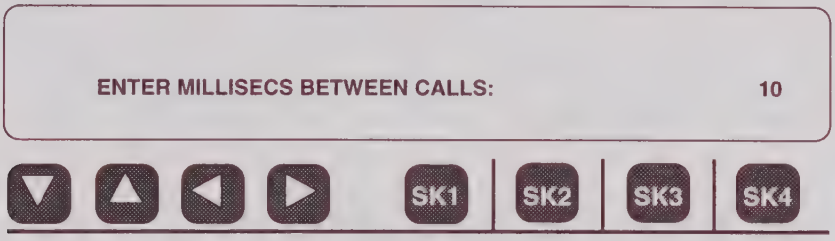
The test results (or call completion status and timing) will be stored in **OPTION MENU # 51: TEST RESULTS**. This information supersedes any wink timing information that might otherwise have been stored in **OPTION MENU # 51: TEST RESULTS**. More information on storing and retrieving test results is provided later in this section.

When the 930A encounters a **T** during batch testing, it goes on to the next call after the test line fails to answer or after the test line answers and tests have been performed. Anything in the sequence after a test line is ignored.

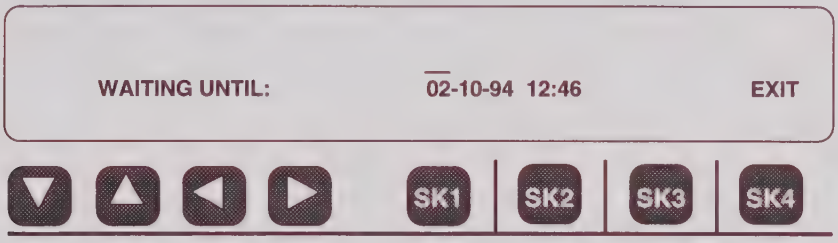
A lowercase **d** causes the 930A to pause for dial tone before proceeding.

6-50.4 Timing

From the main set-up menu, press softkey 1 under **SET-UP**. To set all timing parameters for Batch Mode, press softkey 3 under **TIMING**. You will see the following display:



The valid parameters are between **10** and **9999** milliseconds. Use the numeric keypad and press **ENT** or any softkey. You will see the following screen:



To change the date or time, use the numeric keypad. Use the Left/Right arrow keys to advance the cursor over the parameter to be changed. For each variable, a secondary screen will prompt: **ENTER MONTH:, ENTER DATE:, ENTER YEAR:, ENTER HOUR:, ENTER MINUTE:**. You may also use the Up/Down arrow keys to scroll the parameters.

If the time and date specified are earlier than the current time, testing will begin immediately. This display will remain on the screen until the current time and date are equal to or later than the displayed time and date. Once this occurs, testing will begin. When satisfied with your selections, press softkey 4 under **EXIT**.

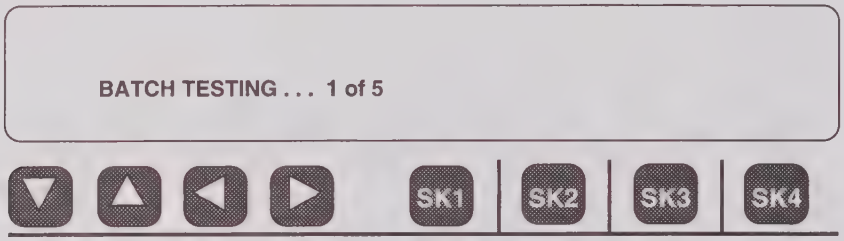
Press softkey 4 under **EXIT** again or the **Option Menu** function key to return to the main set-up menu.

6-50.5 Information

From the main set-up menu, press softkey 3 under **INFO**. The display will allow you to view all set-up parameters at a glance. The first screen shows **TEST RESULTS START AT LOCATION: [N]**. Screen 2 shows **BATCH NUMBER 1 STARTS AT LOCATION: [N]**. The last screen displays **TEST WILL BE PERFORMED [N] TIMES**. You will be returned to the main set-up menu.

6-50.6 Testing

Once the 930A is set-up for call sequence and test time, and has stored any necessary telephone numbers into memory, it is ready to begin batch testing. From the main set-up menu, press softkey 2 under **TEST**. You will see a display much like:

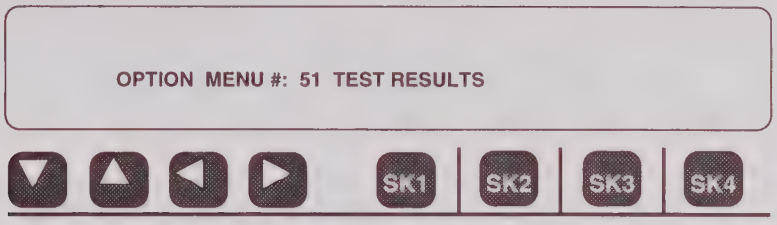


This display will precede each call and show the current trunk being tested and the total number to test. After this display, various displays may appear, depending on the events in the sequence. Telephone numbers will be displayed while they are being sent, wink timing information will be displayed as it becomes available, call completion status and timing will be shown if the call terminates at a test line, and test results will be displayed as the tests complete. To abort batch testing, press any function key. You will see a display similar to:

If softkey 3 under **RESUME** is selected, the following brief message will appear: **RESUMING BATCH TEST...** To end the session, press softkey 4 under **EXIT**. You will be returned to the main set-up menu. Press the **Option Menu** function key to **EXIT** Batch Mode testing.

Test results are automatically stored into the 930A memory locations specified by the user. The 930A will automatically be forwarded to **OPTION MENU # 51: TEST RESULTS.** If there are any test results available and if the 930A is in remote mode, test results will also be sent to a printer or terminal as they occur. Refer to **Section 6-3, Option Menu #: 3 Remote Control** and **Section 7, Remote Control** for complete instructions on using the 930A remotely.

6-51 OPTION MENU #: 51 TEST RESULTS



After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **51** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

Since the 930A can be programmed to place a wide variety of calls in batch mode, with many possible results, the contents of **OPTION MENU #: 51** may vary. Use the **RCL NXT** key to display the test results as they have been recorded.

Possible test results are:

DIGITS SENT SUCCESSFULLY

This display means the call was dialed, no winks were timed, and no test line was specified.

ABORT: NOT DIGIT RECORD!

This display means one of the memory locations specified as the location of a telephone number did not contain a telephone number. The call failed.

W B1 H WINK 310 MSEC (or a similar display)

This display means a pause for a wink, delay-dial event or an off-hook was specified in the call sequence. No test line was specified. As a result, the highest priority information is wink timing. The call sequence is shown and wink timing information is recorded. If a test line and winks are specified as part of the call sequence, the wink timing information will be recorded only if a wink fails and the call sequence aborts before the test line can be reached.

ABORT: REORDER 1.7 SECONDS

This display means a test line was specified in the call sequence. The call proceeded to the point where the test line was expected to answer. The call failed to complete. The network response time and call completion status were recorded. The possible call completion states are: **ABORT: REORDER, ABORT: DEAD LINE, ABORT: RINGING** (no answer after 60 seconds), **ABORT: DIALTONE, ABORT: SPEECH?** and **ABORT: TONE** (a continuous tone other than that provided by the expected test line).

CALL COMPLETE: 3.7 SECONDS

This display means a test line was specified in the call sequence. The call completed successfully. The call completion time is recorded. If any tests were selected, such as Loss or C-Notch Noise, their results follow. The exact test results will depend on the type of test line and the tests selected.

If the 930A is in **COMPUTER** remote mode, a bell will be sent to the host computer when any of these test results are recalled and **OPTION MENU #: 51** is entered. Pressing **W** on your computer keyboard will cause the 930A to send a report to the computer. Pressing **X** on your computer keyboard will cause the 930A to echo its display to the computer. Either method can be used to obtain test results. Refer to **Section 6-3, Option Menu #: 3 Remote Control** and **Section 7, Remote Control** for complete instructions on using the 930A remotely.

If the 930A is in **PRINTER** mode, the 930A will print out both the wink timing and the test results at the end of each call. Refer to **Section 6-3, Option Menu #: 3 Remote Control** and **Section 7, Remote Control** for complete instructions on using the 930A remotely.

If a call sequence includes both a pause for winks (or an off-hook or delay-dial event) and a far-end test line, the call completion time and far-end test line results will overwrite the wink timing information in **OPTION MENU #: 51 TEST RESULTS.** Wink timing for the last trunk tested is available in **OPTION MENU # 9: WINK TIMING**. Wink timing information will only be shown in **OPTION MENU #: 51 TEST RESULTS** if there is no test line specified or the test line could not be reached because an expected supervision event failed.

Press the **Option Menu** function key to exit this option.

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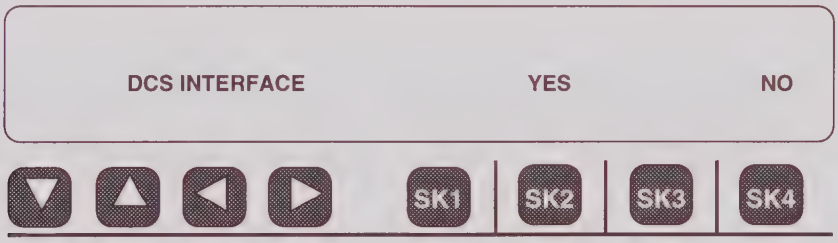
6-54 OPTION MENU #: 54 DCS INTERFACE

This Option Menu number requires *Purchased Option 930A-45, DCS Interface.* The DTAU/DCS Interface (Digital Terminal Access Unit/Digital Cross-connect System) provides standard DCS Test Port access to the test trunk of a DCS frame. This functionality allows the 930A to perform test functions required of a DCS test frame DS-1 test set, including Single Monitor and Split Mode access of unmapped DS-0 channels, Single or Dual Monitor and Dual Split access to mapped DS-0 channels in either direction

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **54** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



To exit the DCS Interface mode, press softkey 4 under **NO**. The 930A will return to the main display.

To enter the DCS Interface mode, press softkey 2 under **YES**. The 930A will enter into the Trunk Type menu and display the following screen:

Press the Up/Down arrow keys to scroll through the test port numbers (**TP#**). The valid parameters are between **1** and **12**.

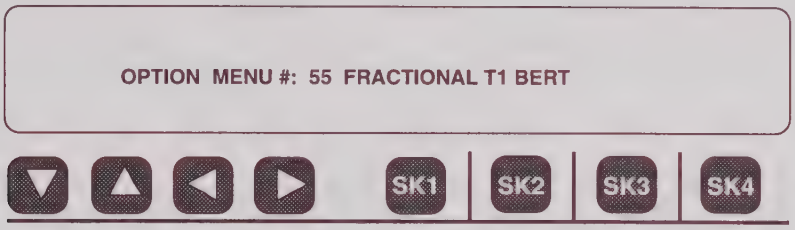
Press softkey 1 to toggle between the **ODD** and **EVEN** channel. If in **ODD** mode, the **Orig** LED indicates the odd circuit and the **Term** LED indicates the even circuit. If in **EVEN** mode, **Orig** indicates the even circuit and **Term** indicates the odd circuit.

Softkey 2 toggles between Monitor mode (**DSC/MON**) and Split mode (**DCS/SPLIT**). Monitor mode supports the DCS functions for Unmapped/Mapped DS-0 channels. Signaling states will be monitored on both sides of the circuit and supervision will be indicated on the 930A front panel. Split mode allows the 930A to send and receive Signaling or BERT DS-0/DDS tests. Split mode provides a **TERMINATE** configuration for sending/receiving on the channel selected.

Softkey 4 enters the PCM set-up screen beginning with the **IMPEDANCE** configuration. See **Section 5, PCM Operation** for specific set-up information.

Press softkey 3 to exit the DCS Interface and enter the main PCM Trunk Type set-up screen.

6-55 OPTION MENU #: 55 FRACTIONAL T1 BERT



This Option Menu number requires *Purchased Option 930A-24, Single Direction BERT* or *-34, Dual Direction BERT.* **OPTION MENU #: 55 FRACTIONAL T1** provides Contiguous, Non-Contiguous and True Non-Contiguous Fractional T1 testing capability for the 930A.

Single direction testing works with *Purchased Option 930A-08E, Single Direction ESF.* Dual direction Drop/Insert testing is only available with *Purchased Option 930A-09E, Dual Drop/Insert w/ ESF.*

This option provides the capability to group single or multiple Sequential, Non-Contiguous, and True Non-Contiguous DS-0 circuits into a single Wideband Data Circuit that can be BERT tested and verified for operation. To test both PCM1 and PCM2, set your Trunk Type to **PCM, D&I**. For PCM1 only, the 930A must be in **TERMINATE** mode. See **Section 5, PCM Operation** for set-up information.

6-55.1 Set-up

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **55** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press **ENT** or any softkey. If you are not in PCM, you will see the message **NOT IN PCM**. Use the Trunk Type function key to select PCM. See **Section 5, PCM Operation** for more details. If you are in PCM, you will see the main set-up menu:

Press softkey 1 under **SET-UP**. You will see:

Select the appropriate data rate for each DS-0. Press softkey 2 for **56 KBIT** or softkey 4 for **64 KBIT**.

You will advance to the next screen:

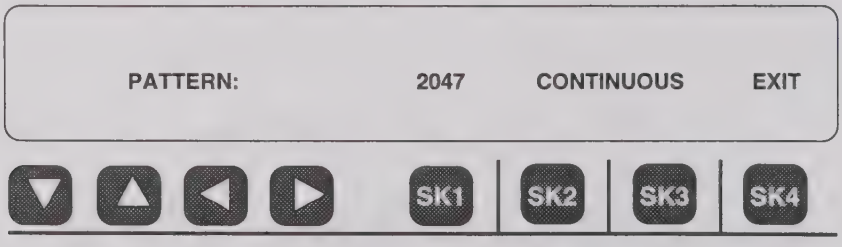
Select Contiguous, Non-Contiguous or True Non-Contiguous DS-0 channels for the Wideband Data Circuit under test. For Non-Contiguous set-up, refer to **Section 6-55.1.2**. For True Non-Contiguous set-up, refer to **Section 6-55.1.3**.

6-55.1.1 Contiguous Set-up

Press softkey 2 under **CONTIG** to see:

Softkey 2 selects the starting channel number (**CH#**). The valid range is between **1** and **24**. Use the numeric keypad to enter the appropriate number. If you specify a number outside of these parameters, the 930A will automatically adjust your selection to a valid number. You may also use the Up/Down arrow keys to scroll through the numbers.

Softkey 3 selects the number of channels to be tested (**N=**). The number of channels to be tested including the starting channel number cannot be greater than 24. For example, if you start testing on channel number 2 (**CH# 2**), the number of channels can not be greater than 22 (the 23 channels tested include channel number 2). Press softkey 3 to move the cursor over the value. The valid range is between **1** and **24**. Use the numeric keypad to enter the appropriate number. If you specify a number outside of the valid parameters, the front panel will display **EXCEEDS LIMITS WITH CH#.** Press any softkey to return to the menu. Press softkey 4 under **EXIT** when your selection is complete. The next display will show:



Press softkey 1 to scroll through the available patterns:

2047
2^{15}
2^{20}
USER
511

Press softkey 2 or 3 to scroll through the time parameters:

CONTINUOUS
15 MINUTES
1 HOUR
24 HOURS

Press **EXIT** when your selection is complete. You will be returned to the main set-up menu.

6-55.1.2 Non-Contiguous Set-up

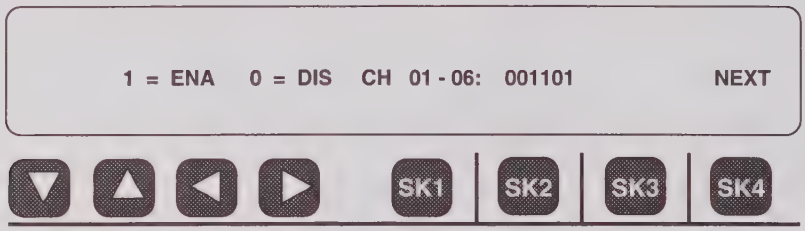
Press softkey 3 under **NON-CON** from the first select menu. You will see:

Selecting **1** from the numeric keypad will enable (**ENA**) a channel. Selecting **0** from the numeric keypad will disable (**DIS**) a channel. The channel numbers, in groups of 6, are displayed above softkeys 1 and 2. The cursor will automatically advance to the next channel number after entering a **1** or **0** from the keypad. You may also use the Left/Right arrow keys to move the cursor over the appropriate channel number. Channels **1-6** are displayed first, followed by channels **7-12**, **13-18** and finally **19-24**. Press softkey 4 under **NEXT** to select the next grouping of six channels. After advancing, the word **PREV** will display above softkey 3:

This enables you to return to the previous group of six channels. When you have completed entering all 24 channels, you will be returned to the **PATTERN** menu. At this time, you may verify your **PATTERN** selection. Press **EXIT** to return to the main set-up menu.

6-55.1.3 True Non-Contiguous Set-up

Press softkey 3 under **NON-CON** from the first select menu. You will see:



Selecting **1** from the numeric keypad will enable (**ENA**) a channel. Selecting **0** from the numeric keypad will disable (**DIS**) a channel. The channel numbers, in groups of 6, are displayed above softkeys 1 and 2. The cursor will automatically advance to the next channel number after entering a **1** or **0** from the keypad. You may also use the Left/Right arrow keys to move the cursor over the appropriate channel number. Channels **1-6** are displayed first, followed by channels **7-12**, **13-18** and finally **19-24**. Press softkey 4 under **NEXT** to select the next grouping of six channels. After advancing, the word **PREV** will display above softkey 3:

This enables you to return to the previous group of 6 channels. When you have completed entering all 24 channels, you will be returned to the **PATTERN** menu. At this time, you may verify your **PATTERN** selection. Press **EXIT** to return to the main set-up menu.

6-55.2 Testing

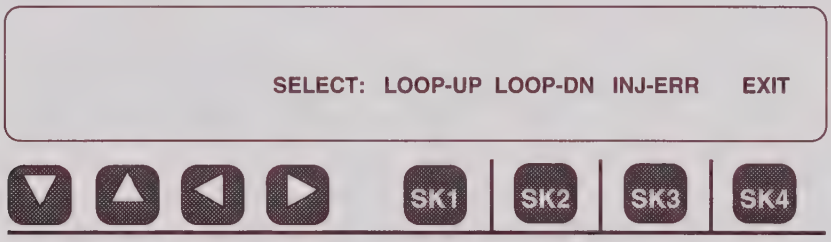
From the main set-up menu, press softkey 2 under **TEST**. You will see:

Press softkey 1 or the Up/Down arrow keys to scroll through the tests and their results.

The available tests are:

BIT ERRS	(BIT ERRORS)
BER	(BIT ERROR RATE)
BPV ERRS	(BIPOLAR VIOLATION ERRORS)
BPVR	(BIPOLAR VIOLATION RATE)
FR ERRS	(FRAME ERRORS)
FR LOSS	(FRAME LOSS)
BIT SLIP	
FR SLIP	(FRAME SLIP)
SLS	(SYNC LOSS SECONDS)
EFS	(ERROR FREE SECONDS)
%EFS	
ES	(ERRORED SECONDS)
%ES	
SES	(SEVERELY ERRORED SECONDS)
%SES	
FAILED	
%FAILED	
AVAIL	
%AVAIL	
UNAVAIL	
%UNAVAIL	
ELAPSED	

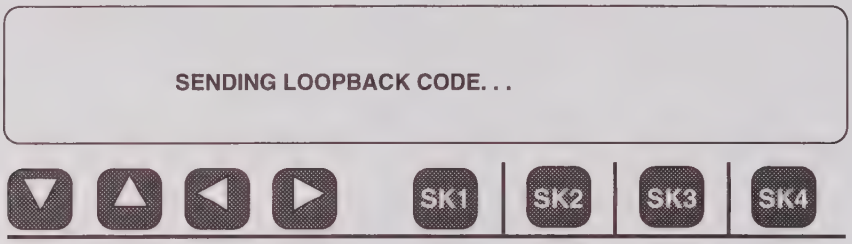
Press softkey 4 under **MENU**. You will see:



If it is necessary to send a loop-up code, press softkey 1 under **LOOP-UP** to see:

Press softkey 4 to exit this option without sending the loop-up code.

To send the loop-up code, press softkey 2 under **SEND**. The display will show:



When the loop-up is completed, the 930A will return to the test screen.

If errors are detected, the 930A will display error indications above softkey 1. If you do not see any errors within 15 minutes (scroll through all the error counters using softkey 1 or the Up/Down arrow keys), the span is probably working. If the problem is intermittent, run the test for at least 24 hours. Return to **Section 6-46.1** for information on the 930A's **TEST LENGTH**. To test the integrity of the loop, press softkey 4 under **MENU**. Press softkey 3 under **INJ ERR** (inject error) once and you will see a display similar to:

Press softkey 4 to exit this display. You will see the test screen. If you did not specify **CONTINUOUS** testing, you will see the message **TESTING COMPLETE** and the end of your test. Press the **Option Menu** function key to exit this display. If **CONTINUOUS** testing was specified, you may abort by pressing the **Option Menu** function key.

If you press softkey 2 under **TEST** again, you will see:

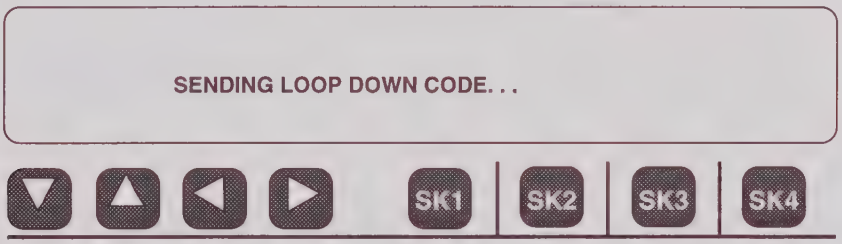
Press softkey 3 under **YES** to resume testing. You will be returned to the test screen. Press softkey 4 for **NO** to return to the **SELECT** menu.

If you resumed testing, you may abort by pressing the **Option Menu** function key.

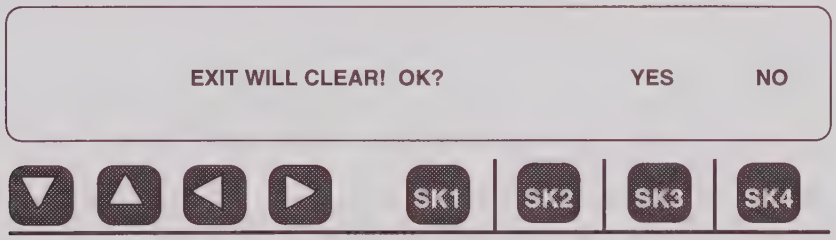
Once testing is complete, you will be returned to the **SELECT** menu. If it is necessary to send a loop-down code, press softkey 2 under **TEST**. Press softkey 4 under **MENU** to see:

Press softkey 2 under **LOOP-DN** and the display will change to:

Press softkey 3 to send the loop-down code. The display will show:



When the loop-down is completed, the 930A will return to the test screen. To exit, press the **Option Menu** function key. You will be returned to the previous submenu. Testing will continue until you press softkey 4 under **EXIT** or the **Option Menu** function key. At this time you will see:



Press softkey 4 under **NO** to resume testing or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-55.3 History

To review the errors which have been recorded, press softkey 3 under **HISTORY**. If no tests have been made, you will see the message **NO BERT HISTORY AVAILABLE**. Otherwise, you will see:

6-55.3.1 View

To view test results on the 930A front panel, press softkey 2 under **VIEW**. You will see a display similar to:

The above display shows the 61st 15-minute block of time since the test began. To find out what has gone on over this time period, press softkey 3 under **BLK: 61**. The 930A display will begin at Block 1. Continue pressing softkey 3 to scroll through the remaining 60 blocks. Note that the time above softkey 4 changes with each block.

If you are monitoring both sides of the line, pressing softkey 2 will toggle to **PCM2**. The same results apply as for **PCM1**.

Press softkey 1 or the Up/Down arrow keys to scroll through the remaining tests. Press the **Option Menu** function key to return to the main **SELECT** menu.

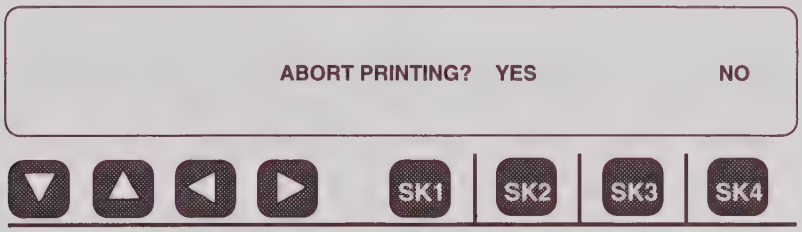
6-55.3.2 Print

If *Purchased Option 930A-10C, Remote Control Interface* is installed, you may connect a printer or computer to the 930A and view the results via terminal or printout. See **Section 7, Remote Control** for instructions on connecting a printer or computer to your 930A. To send out the results to date, press softkey 3 under **HISTORY**. Press softkey 3 again under **PRINT.** You will see:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be sent. If you press softkey 3 under **ALL**, every test in every block will be sent. Press softkey 1 under **RANGE** to specify the number of blocks you wish to send. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 fifteen-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

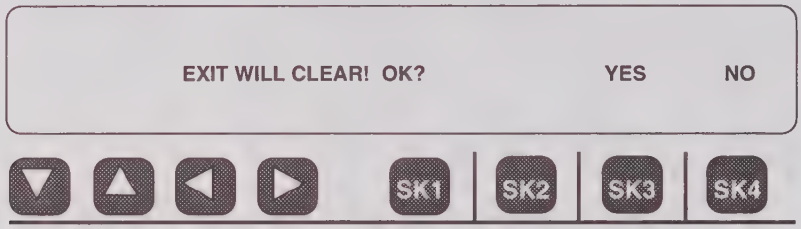
To abort sending data, press any softkey or the **Option Menu** function key to see the screen below:



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:

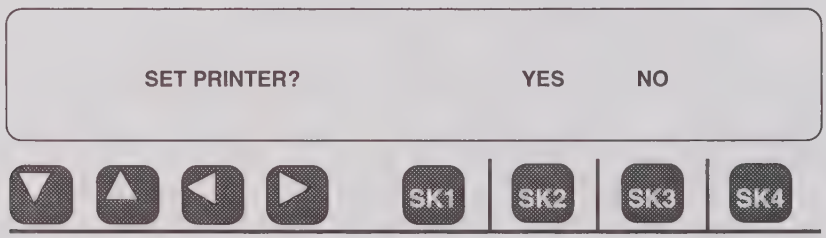
Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:



Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

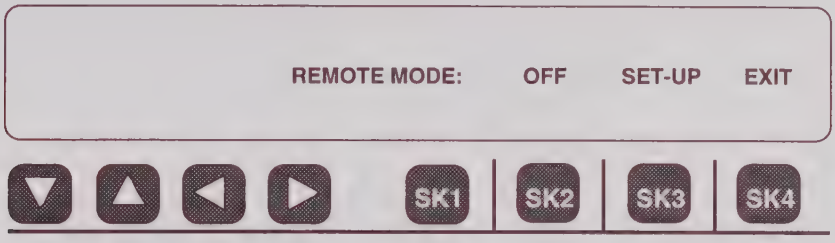
6-55.3.2.1 Not In Printer Mode

If you have not set the 930A to **PRINTER, COMPUTER** or **TERMINAL** mode (via **OPTION MENU #: 3 REMOTE CONTROL**) you will see a brief message **NOT IN PRINTER MODE!** and then the display:



Press softkey 3 under **NO** to discontinue the set-up procedure. You will be returned to the previous screen.

To set the parameters for your printer, press softkey 2 under **YES** to advance to the **REMOTE MODE** display:

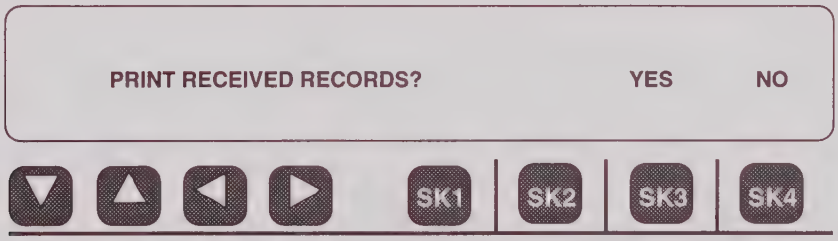


Press softkey 2 under **OFF** to scroll through the available remote options. Press softkey 3 under **SET-UP** to set the baud rate, parity and bit #. Refer to **Section 6-3, Remote Control** for set-up instructions.

After completing the **SET-UP**, press softkey 4 under **EXIT**. The 930A will advance to a series of questions regarding printing parameters. To bypass these displays, press the **Option Menu** function key to return to the main **PRINT** menu.

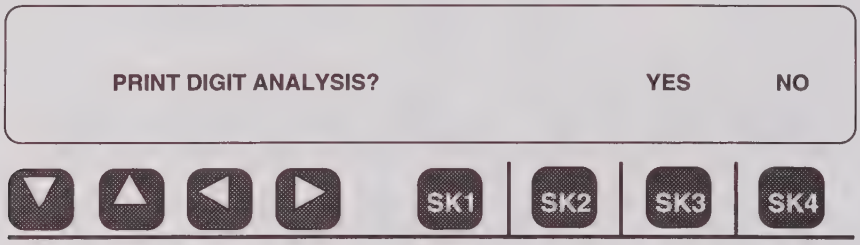
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT ERRORS**?

To send PCM errors, press softkey 3 under **YES**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:



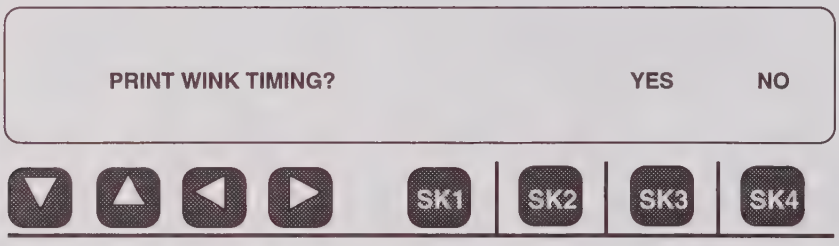
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT RECEIVED RECORDS**?

To send calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4. Selecting **YES** displays the following screen. Selecting **NO** skips the following screen:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT DIGIT ANALYSIS**?

To send the analysis of the received digits, press softkey 3 under **YES**, otherwise press softkey 4. The 930A display advances to:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT WINK TIMING**?

To send the wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A will exit the Option Menu. The printer will begin to print whenever one of the conditions occurs, or whenever the **ENT** key on the 930A is pressed.

Press the **ENT** key to test your connection. If the output is garbled, adjust the baud rate, parity, or number of bits. To suspend printing for any reason without taking the 930A out of Printer mode, turn off the printer.

> *Taking the printer off-line instead of turning off the power may not have the desired effect. The printer buffer may fill up with unwanted material which will be printed out when the printer is placed back on-line.*

You will be returned to the **PRINT** menu:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be printed. If you press softkey 3 under **ALL**, every test in every block will be printed. Press softkey 1 under **RANGE** to specify the number of blocks you wish to print. You will see:

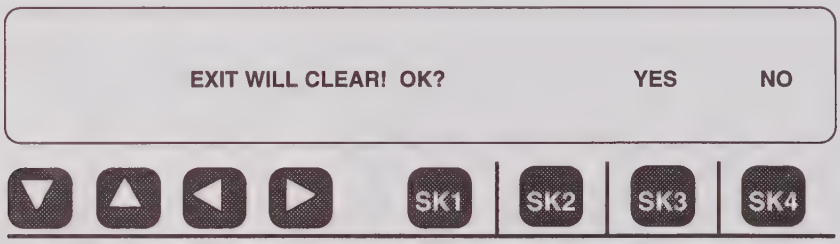
The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 fifteen-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

To abort printing, press any softkey or the **Option Menu** function key to see the screen below.

If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:

Press softkey 3 under **TOTAL** to send the accumulated total of errors in each block. Press softkey 4 under **ALL** to send every test in every block. Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:



Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-56 OPTION MENU #: 56 DS-0 BIT ERROR RATE

This Option Menu requires *Purchased Option 930A-22., DS-1 BERT.* This feature enables you to test at the 56 KBps or 64 KBps rates. It does not test individual sub-rates such as 9.6 KBps.

Press the **Trunk Type** function key. Select **PCM**. Select **TERMINATE** or **D&I** mode. Refer to **Section 5, PCM Operation** for set-up information in the PCM Trunk Type. The following sections outline test cord connections, BER testing in various situations, how to send loop-up and down codes and how to change the test parameters if you have to.

6-56.1 DS-0 Terminate Test Configuration

A diagram of the 930A connected for Terminate testing is provided below:

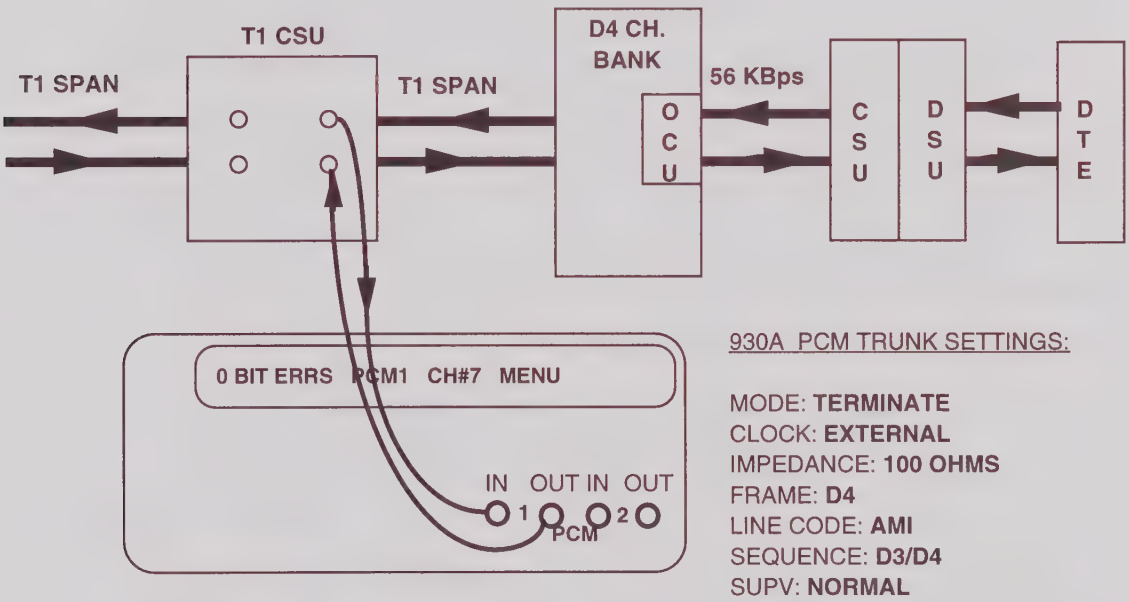


Figure 6-56.1
DS-0 BERT CONFIGURATION

In the above example the 930A has been connected at the Equipment side of the customer's T1 Channel Service Unit (CSU). The testing is toward the D4 Channel Bank. There is an Office Channel Unit (OCU) data port plugged into time slot 7 or channel 7 on the bank. The 56 KBps output from the OCU is fed to a combination Channel Service Unit/Data Service Unit (DSU) which interfaces to the Data Terminal Equipment (DTE). To test the path successively, loopback the devices on the path and run a BER test until errors are found. Start by looping the OCU, then the 56 KBps CSU, and finally the DSU.

6-56.2 DS-0 Drop/Insert Test Configuration

A diagram of the 930A connected for Drop /Insert testing is provided below.

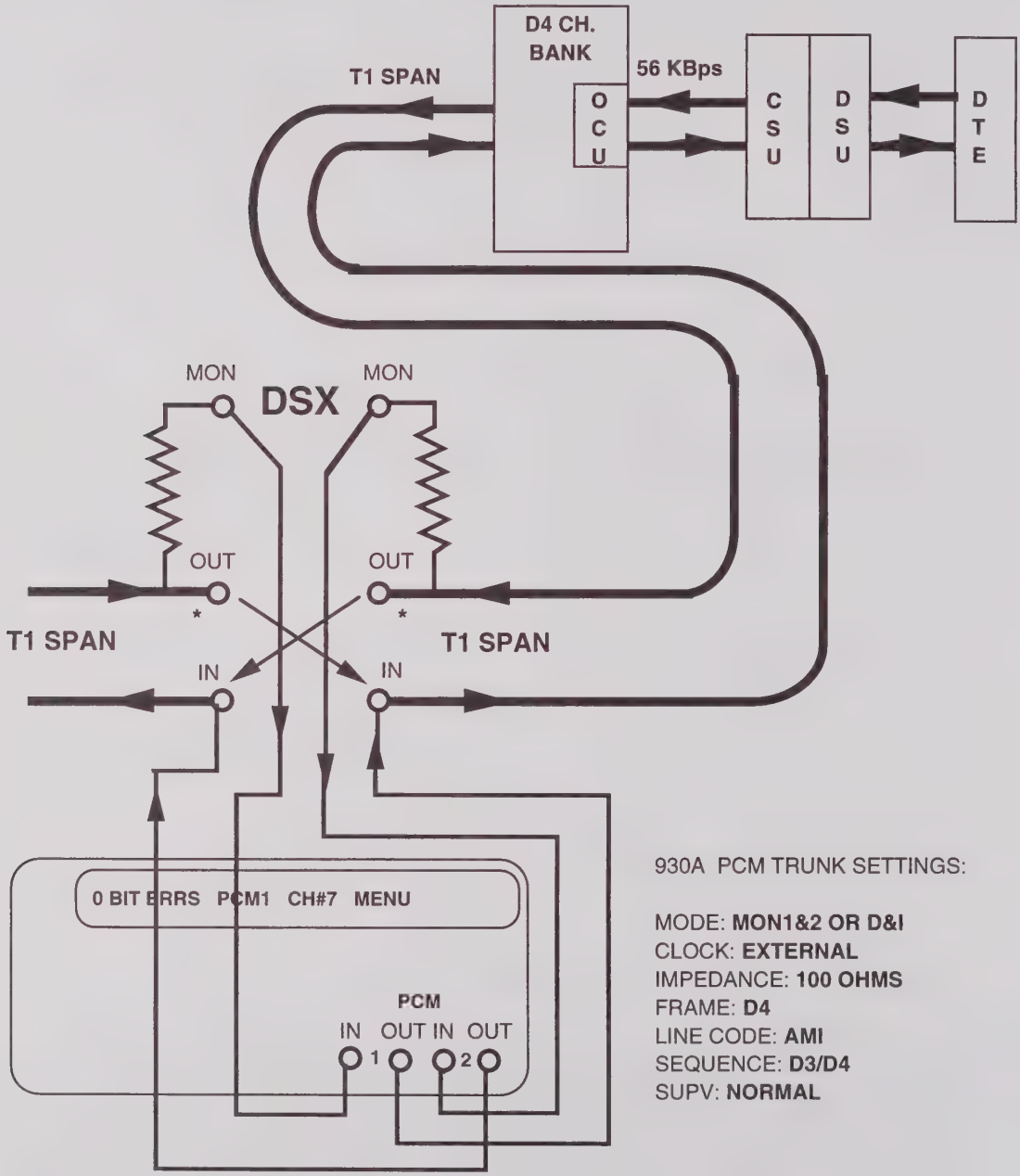
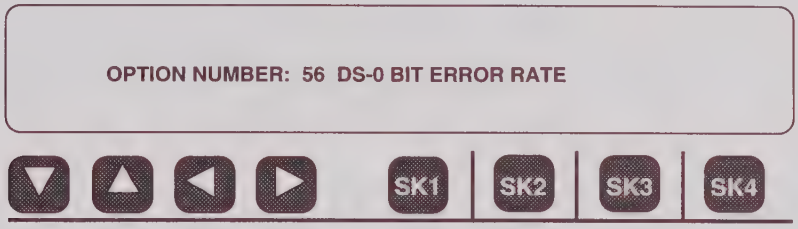


Figure 6-56.2
DS-0 BERT DROP AND INSERT

Once you have set the 930A correctly and connected the test cords, you can test in either direction on any channel without disturbing the other 23 channels on the T1 span.

6-56.3 DS-0 BERT Set-up Requirements

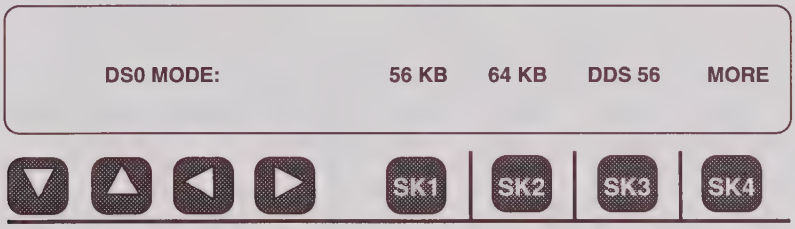


If you select **AMI** line code and **ROBBED BIT** signaling under the PCM Trunk Type, DS-0 testing functions at **56 KB** only. If you select **CCIS** signaling for the DS-1, select the DS-0 rate at **64 KB** and **CLEAR-CHANNEL** signaling.

> *You cannot pass 64K DS-0 BERT successfully unless you adhere to the **CLEAR-CHANNEL** rule above.*

After connecting the 930A to the span under test, press the **Option Menu** function key. Enter **56** from the numeric keypad and press **ENT**. (After selecting the **Option Menu** function key, you may also press the Up/Down arrow keys to select an **OPTION MENU #**. Press **ENT** to activate your selection.) The following screen will display:

Press softkey 1 under **SET-UP**:



6-56.3.1 DS-0 Mode

Press softkey 1, 2 or 3 accordingly. If the cursor is highlighting your choice, you may either press the softkey under that parameter or softkey 4 under **MORE**. If you choose DDS mode, refer to **Section 6-56.5, DDS 56 Set-up** for loopback set-up instructions and testing guidelines.

If in **56 KB** or **64 KB** mode, you will see:

The default pattern is a **2047** pseudo-random sequence, with a **CONTINUOUS TEST** time parameter. Press softkey 1 or the Up/Down arrow keys to scroll through the pattern choices.

The following patterns are available:

2047 bits
511 bits
1 : 7
USER (inputs any 8 bit pattern)

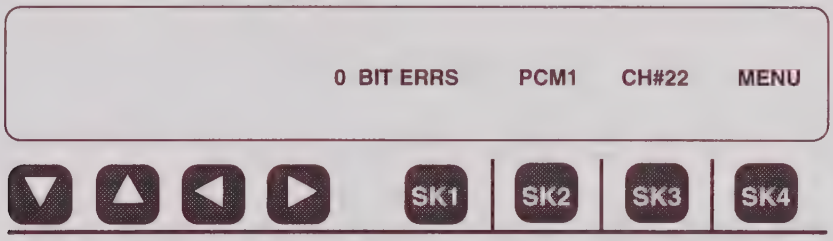
The following test durations are available:

CONTINUOUS
15 MINUTE TEST
1 HOUR TEST
24 HOUR TEST

Press softkey 2 or 3 to scroll through the test durations. Press softkey 4 under **EXIT** when your pattern and test duration parameters have been chosen. If you selected **2047, 511** or **1:7** pattern, you will be returned to the main **SELECT** menu. If you selected the **USER** pattern, the next display allows you to enter any 8 bit pattern of 1s and 0s. Press softkey 4 under **MORE** when complete. You will be returned to the main **SELECT** menu.

6-56.3.2 DS-0 Testing

Press softkey 2 under **TEST** to begin testing. You will see:



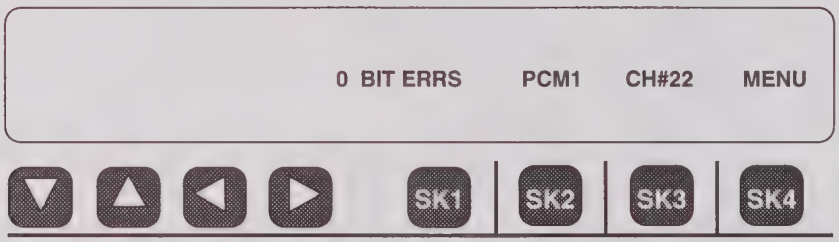
Press softkey 1 or use the Up/Down arrow keys to scroll through the tests and their results. The available tests are:

BIT ERRS	(BIT ERRORS)
BER	(BIT ERROR RATE)
BPV ERRS	(BIPOLAR VIOLATION ERRORS)
BPVR	(BIPOLAR VIOLATION RATE)
FR ERRS	(FRAME ERRORS)
FR LOSS	(FRAME LOSS)
BIT SLIP	
FR SLIP	(FRAME SLIP)
SLS	(SYNC LOSS SECONDS)
EFS	(ERROR FREE SECONDS)
%EFS	
ES	(ERRORED SECONDS)
%ES	
SES	(SEVERELY ERRORED SECONDS)
%SES	
FAILED	
%FAILED	
AVAIL	
%AVAIL	
UNAVAIL	
%UNAVAIL	
ELAPSED	

To test the integrity of the connection by forcing errors over the channel under test, press softkey 4 under **MENU**:

Press softkey 3 under **INJ-ERR** to proceed, or select **EXIT** to return to the previous display. If you proceed, you will see:

Press softkey 2 to inject a single error. Notice the error counter above softkey 1 has increased by one. Press softkey 3 under **INJ6ERR** to inject six bit errors at a time. Notice the error counter above softkey 1 has increased by six. Press softkey 4 to return to the test display.



If you are in **D&I** mode, you may monitor both PCM1 and PCM2. Press softkey 2 under **PCM1**. You will see the message **WILL RESTART TEST - CONT? YES NO**. Press softkey 3 under **YES** to toggle to PCM2. Press softkey 4 under **NO** to continue monitoring in PCM1. The previous error injection procedures apply when monitoring in PCM2.

Each time you toggle between PCM1 and PCM2, the **RESTART** prompt will appear.

If you did not select **CONTINUOUS** testing, the monitor will display **TEST COMPLETED** at the end of the designated test duration.

Press the **Option Menu** function key to exit this display.

6-56.4 Point-to-Point DS-0 BERT

If you are testing point-to-point over a T1 span, use a 930A set at each end of the span.

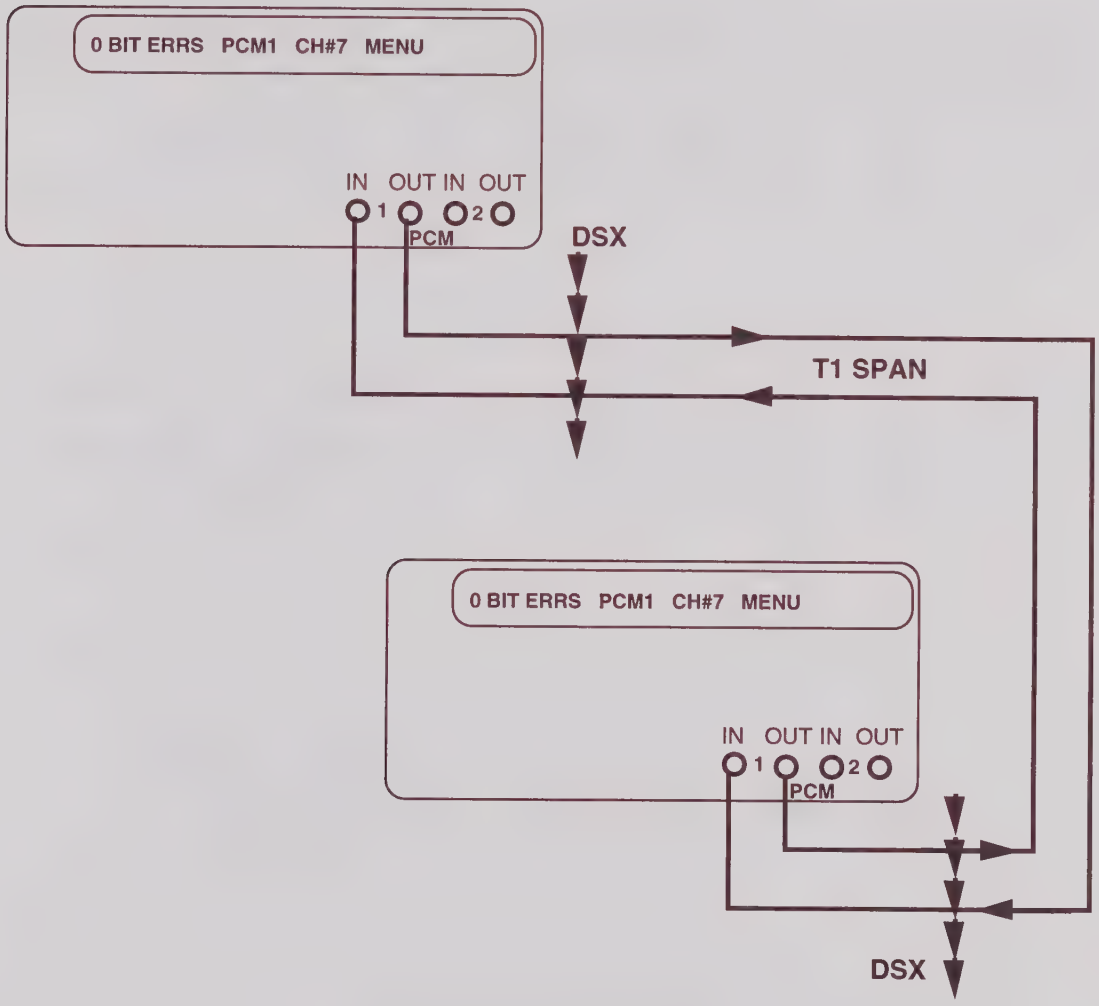


Figure 6-56.3
DS-0 BERT WITH TWO 930A TEST SETS

6-56.5 Loopback BERT on DDS Trunks

To force the 930A to loopback a DS-0 channel under test, go to **OPTION MENU # 57: DS-0 LOOPBACK** and choose **DIGITAL LOOPBACK** then select **LOOP**. Refer to **Section 6-57** for set-up instructions.

DDS equipment responds to digital loop-up and loop-down commands; you can test from one 930A into the DS-0 channel without a second 930A at the far-end. Refer to **Section 6-56.5.1, DDS 56 Set-Up** for information on manual loopback when testing to a Customer Service Unit (CSU), Office Channel Unit (OCU) or Data Service Unit (DSU).

Set-up the 930A for either **TERMINATE** or **D&I** mode. Connect the test cords at the DSX or at a T1 CSU.

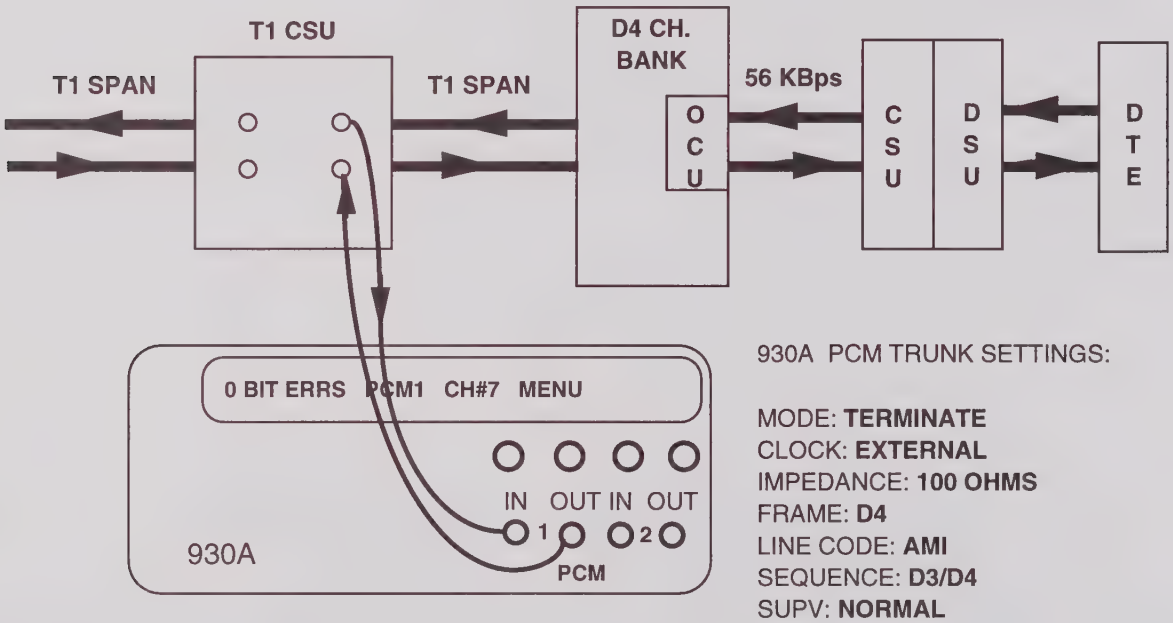


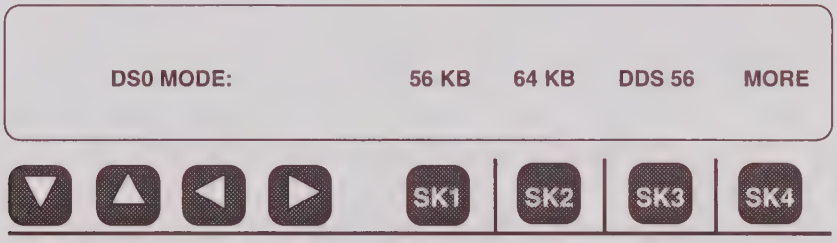
Figure 6-56.4
LOOPBACK BERT SET-UP

In the above example, the equipment side of the T1 CSU is connected to a D4 channel bank, which in turn feeds a 56 KB OCU on Channel 7 to a CSU/DSU. Testing would normally begin by looping the DSU back and running a BER test for approximately 15 minutes with a number of different stress patterns. If errors are encountered, you must successively loopback the equipment on the trunk to determine where the problem is. Next, loopback the 56 KBps CSU and repeat the test pattern. If find no errors, the DSU is bad. If the errors still persist, loopback the OCU. If errors are found, the OCU is bad. If errors are not found, most likely the CSU is bad or the line interface connection to it is bad.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **56** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press **ENT** or any softkey to see:

Press softkey 1 under **SET-UP**:



6-56.5.1 DDS 56 Set-up

Press softkey 3 under **DDS 56** to see:

The default pattern is **2047**, with a **CONTINUOUS TEST** time parameter. Press softkey 1 or the Up/Down arrow keys to scroll through the pattern choices.

The following patterns are available for DDS testing:

2047
511
1:7
USER

The following test durations are available:

CONTINUOUS
15 MINUTE TEST
1 HOUR TEST
24 HOUR TEST

Press softkey 2 or 3 to scroll through the test durations. Press softkey 4 under **EXIT** when your pattern and test duration parameters have been chosen. If you selected **2047, 511** or **1:7** pattern, you will be returned to the main **SELECT** menu. If you selected the **USER** pattern, the next display allows you to enter any 8 bit pattern of 1s and 0s.

*The **1:7** and **USER** patterns are invalid for Alternating Loop-Back testing.*

Press softkey 4 under **MORE** when complete. You will be returned to the main **SELECT** menu.

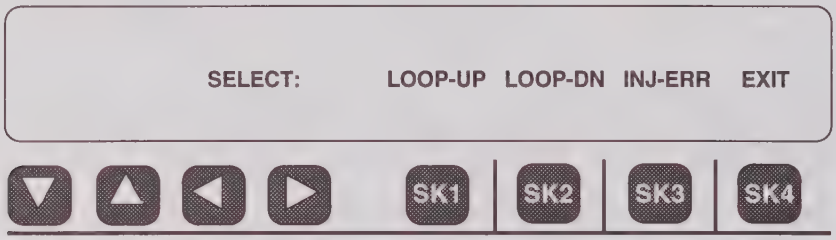
6-56.5.2 DDS Testing

Press softkey 2 under **TEST** to begin testing. You will see:

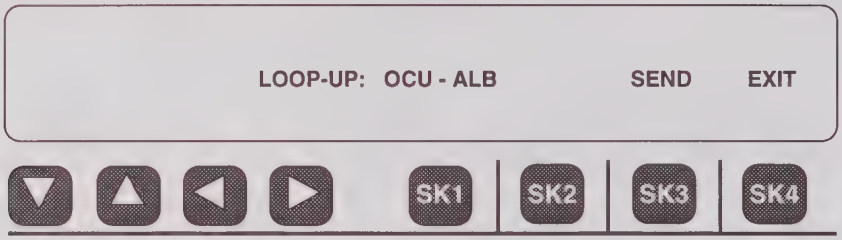
Press softkey 1 or use the Up/Down arrow keys to scroll through the tests and their results. The available tests are:

BIT ERRS	(BIT ERRORS)
BER	(BIT ERROR RATE)
BPV ERRS	(BIPOLAR VIOLATION ERRORS)
BPVR	(BIPOLAR VIOLATION RATE)
FR ERRS	(FRAME ERRORS)
FR LOSS	(FRAME LOSS)
BIT SLIP	
FR SLIP	(FRAME SLIP)
SLS	(SYNC LOSS SECONDS)
EFS	(ERROR FREE SECONDS)
%EFS	
ES	(ERRORED SECONDS)
%ES	
SES	(SEVERELY ERRORED SECONDS)
%SES	
FAILED	
%FAILED	
AVAIL	
%AVAIL	
UNAVAIL	
%UNAVAIL	
ELAPSED	

If you have a 930A (or other BERT set) at the far-end in **DIGITAL LOOPBACK** mode, the near-end 930A is commanding the far-end device to send a loopback code. To manually loop the far-end device (OCU, CSU, DSU), press softkey 4 under **MENU** to see:



Press Softkey 2 under **LOOP-UP** to see:



Press softkey 1 or use the Up/Down arrow keys to scroll through the available loopback patterns. The available patterns are:

OCU-ALB	Office Channel Unit Alternating Loopback
CSU-ALB	Channel Service Unit Alternating Loopback
DSU-ALB	Data Service Unit Alternating Loopback
DP DROP-LLB	Dataport Drop-Latching Loopback
OCU-LLB	Office Channel Unit Latching Loopback
CSU-LLB	Channel Service Unit Latching Loopback

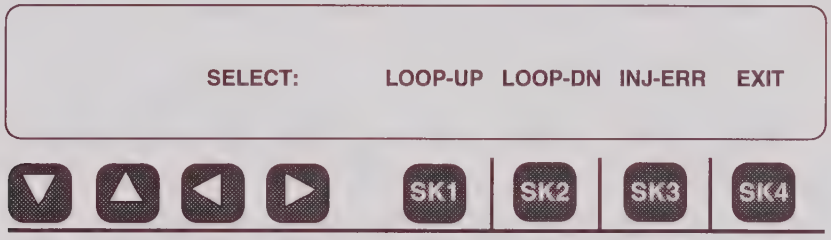
CSU Loopback cannot be performed if there are 56 KB repeaters connected in the line.

Press softkey 4 under **EXIT** to return to the previous screen without sending a loopback pattern. Press softkey 3 under **SEND** to transmit the pattern. If you chose the pattern **1:7** or **USER**, the 930A will display **NO ALTERNATING LB CODE WITH FIXED PATRN**. Otherwise, if you selected any of the Alternating Loopback codes (**ALB**) you will see a brief display: **ESTABLISHING LOOP...**. If you selected any of the Latching Loopback (**LLB**) patterns, the display will read **SENDING LOOPBACK CODE...** After establishing a loop, you may not change codes before sending a loop-down code. If you do, you will see a brief error display: **LOOP DOWN BEFORE CHANGING LOOP CODE!**

When the loopback is successful, the 930A display will return to the main test display:

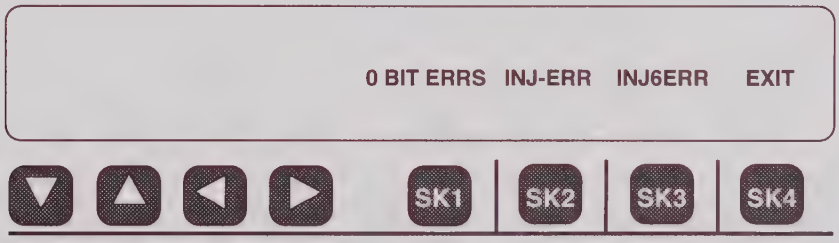
Note that the **NO PATTERN SYNC** indication has now been replaced by the bit errors count.

To test the integrity of the loop, you can send a single error to see if it comes back. Press softkey 4 under **MENU** to see:



6-56.5.3 Inject Error

Press softkey 3 under **INJ-ERR**:



Press softkey 2 to inject a single error. Note that the error counter has increased by one. Press softkey 3 under **INJ6ERR** to inject six bit errors at a time. Note that the error counter has increased by 6. Press softkey 4 to return to the previous **SELECT** display.

You can change test patterns by re-entering the set-up menu. The 930A will re-send the selected loopback code automatically when you re-enter the test menu.

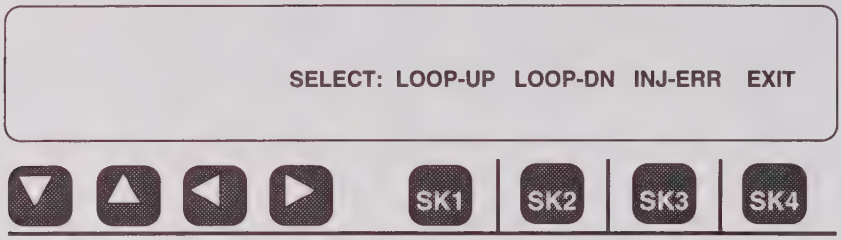
If you are in **D&I** mode, you may monitor both PCM1 and PCM2. Press softkey 2 under **PCM1**. You will see the message **WILL RESTART TEST - CONT? YES NO**. Press softkey 3 under **YES** to toggle to PCM2. Press softkey 4 under **NO** to continue monitoring in PCM1. The previous error injection procedures apply when monitoring in PCM2.

Each time you toggle between PCM1 and PCM2, the **RESTART** prompt will appear.

If you did not select **CONTINUOUS** testing, the monitor will display **TEST COMPLETED** at the end of the designated test duration.

Press the **Option Menu** function key to exit this display.

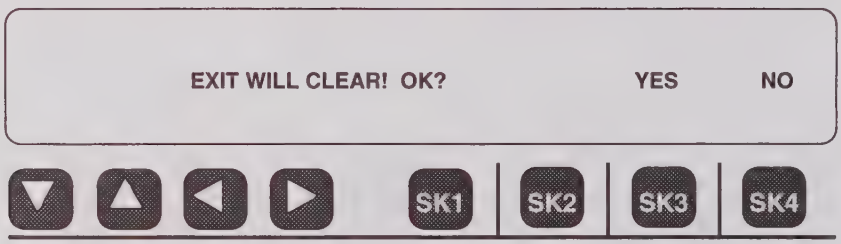
If it is necessary to send a loop-down code, press the Option Menu function key to return to the main **SELECT** menu. Press softkey 2 under **TEST**. Press softkey 4 under **MENU** to see:



6-56.5.4 Loop-down

Press softkey 2 under **LOOP-DN.** If you select any of the Alternating Loopback patterns **(ALB)**, you will see a brief display: **LOOP CODES STOPPED...** If you selected any of the Latching Loopback patterns (**LLB**), the display will read **SENDING LOOP DOWN CODE**...

When the loop-down is completed, the 930A will return to the test screen. To exit, press the Option Menu function key. You will be returned to the previous submenu. Testing will continue until you press softkey 4 under **EXIT** or the **Option Menu** function key. At this time you will see:



Press softkey 4 under **NO** to resume testing and softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-56.6 Switched 56 KB BERT

Set the PCM Trunk Type to **TERMINATE** or **D&I** as appropriate. Place the front panel hookswitch in the **Off Hook** position. Press the **Dial/Ring** function key and set-up the call in the appropriate signalling type (usually dial pulse **[DP]**). Refer to **Section 3, Function Key Operation** for information on the **Dial/Ring** function key. Return to **OPTION MENU #: 56 DS-0 BERT** and follow standard procedure as outlined in **Section 6-56.1**. To drop the call at the end of the test, exit this option. Place the hookswitch in the **On Hook** position when complete.

6-56.7 History

To review the errors which have been recorded, press softkey 3 under **HISTORY**. If no tests have been made, the message **NO BERT HISTORY AVAILABLE** will be displayed. Otherwise, you will see:

6-56.7.1 View

To view test results on the 930A front panel, press softkey 2 under **VIEW**. You will see a display similar to:

The above display shows the 61st 15-minute block of time since the test began. To find out what has gone on over this time period, press softkey 3 under **BLK: 61**. The 930A display will begin at Block 1. Continue pressing softkey 3 to scroll through the remaining 60 blocks. Note that the time above softkey 4 changes with each block.

If you are monitoring both sides of the line, pressing softkey 2 will toggle to **PCM2**. The same results apply as for **PCM1**.

Press softkey 1 or the Up/Down arrow keys to scroll through the remaining tests. Press the **Option Menu** function key to return to the main **SELECT** menu.

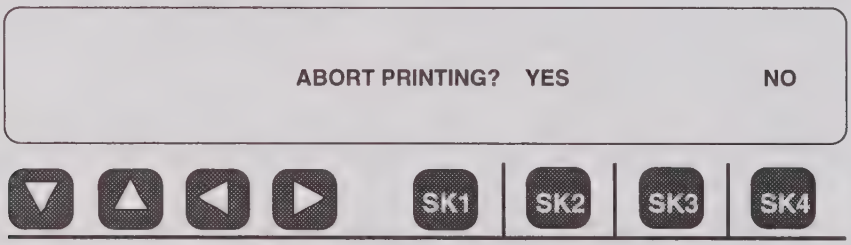
6-56.7.2 Print

If *Purchased Option 930A-10C, Remote Control Interface* is installed, you may connect a printer or computer to the 930A and view the results via terminal or printout. See **Section 7, Remote Control** for instructions on connecting a printer or computer to your 930A. To send out the results to date, press softkey 3 under **HISTORY**. Press softkey 3 again under **PRINT.** You will see:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be sent. If you press softkey 3 under **ALL**, every test in every block will be sent. Press softkey 1 under **RANGE** to specify the number of blocks you wish to send. You will see:

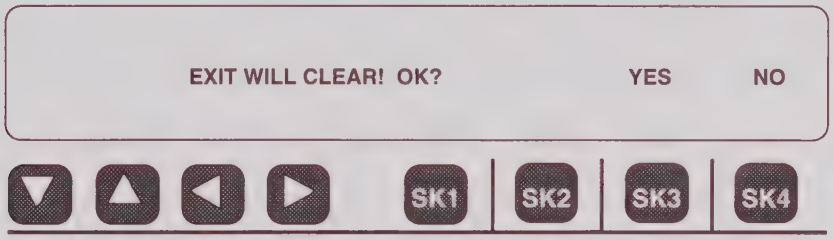
The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

To abort printing, press any softkey or the **Option Menu** function key to see the screen below:



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume. If you select nothing, you will be returned to the **PRINT** screen:

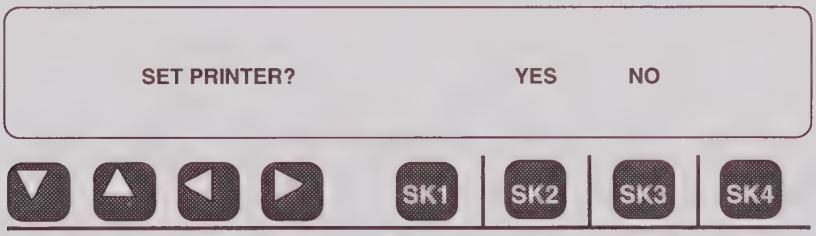
Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:



Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

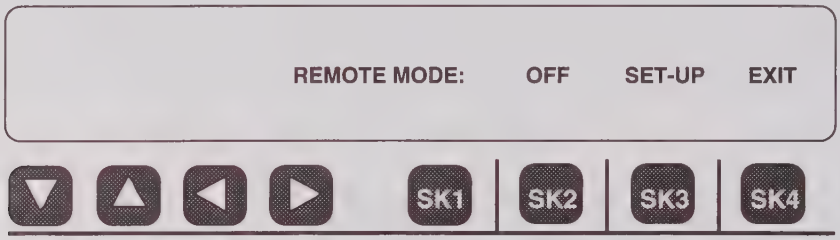
6-56.7.2.1 Not In Printer Mode

If you have not set the 930A to **PRINTER, COMPUTER** or **TERMINAL** mode (via **OPTION MENU #: 3 REMOTE CONTROL**) you will see a brief message **NOT IN PRINTER MODE!** and then the display:



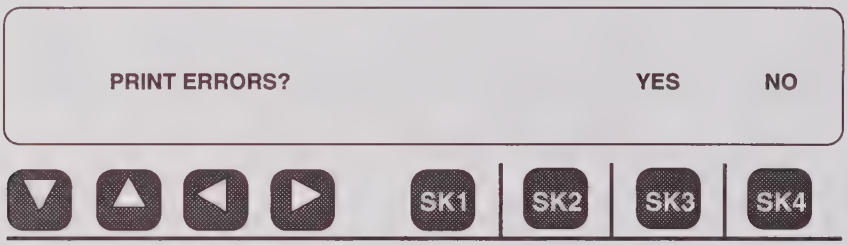
Press softkey 3 under **NO** to discontinue the set-up procedure. You will be returned to the previous screen.

To set the parameters for your printer, press softkey 2 under **YES** to advance to the **REMOTE MODE** display:



Press softkey 2 under **OFF** to scroll through the available remote options. Press softkey 3 under **SET-UP** to set the baud rate, parity and bit #. Refer to **Section 6-3, Remote Control** for set-up instructions.

After completing the **SET-UP**, press softkey 4 under **EXIT**. The 930A will advance to a series of questions regarding printing parameters. To bypass these displays, press the **Option Menu** function key to return to the main **PRINT** menu.

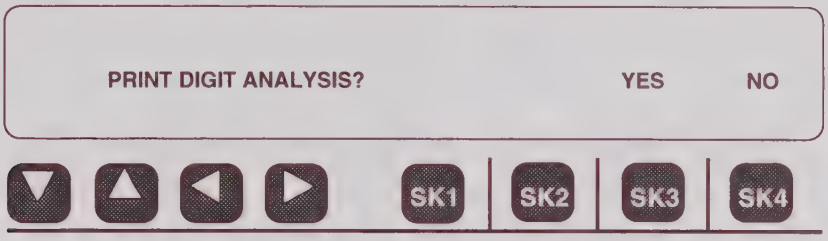


If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT ERRORS**?

To send PCM errors, press softkey 3 under **YES**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:

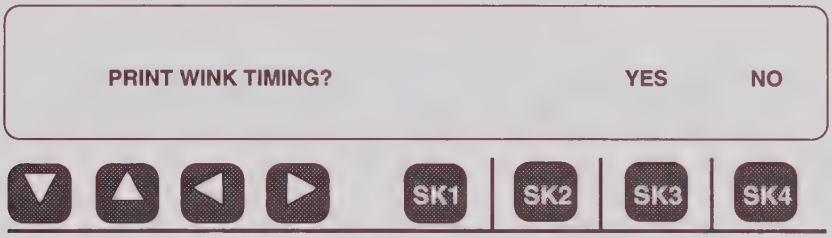
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT RECEIVED RECORDS**?

To send calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4. Selecting **YES** displays the following screen. Selecting **NO** skips the following screen:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT DIGIT ANALYSIS**?

To send the analysis of the received digits, press softkey 3 under **YES**, otherwise press softkey 4. The 930A display advances to:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT WINK TIMING**?

To send the wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A will exit the Option Menu. The printer will begin to print whenever one of the conditions occurs, or whenever the **ENT** key on the 930A is pressed.

Press the **ENT** key to test your connection. If the output is garbled, adjust the baud rate, parity, or number of bits. To suspend printing for any reason without taking the 930A out of Printer mode, turn off the printer.

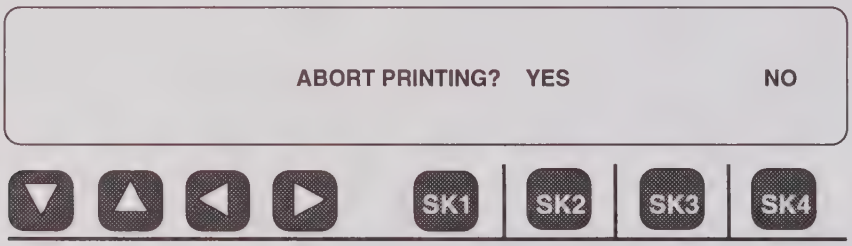
Taking the printer off-line instead of turning off the power may not have the desired effect. The printer buffer may fill up with unwanted material which will be printed out when the printer is placed back on-line.

You will be returned to the **PRINT** menu:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be printed. If you press softkey 3 under **ALL**, every test in every block will be printed. Press softkey 1 under **RANGE** to specify the number of blocks you wish to print. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

To abort printing, press any softkey or the **Option Menu** function key to see the screen below.



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:

Press softkey 3 under **TOTAL** to send the accumulated total of errors in each block. Press softkey 4 under **ALL** to send every test in every block. Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:

Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

6-57 OPTION MENU #: 57 DS-0 LOOPBACK

The 930A can loopback the selected PCM channel in **TERMINATE** or drop/insert (**D&I**) modes. This is similar to a hard loopback in operation because no codes are involved.

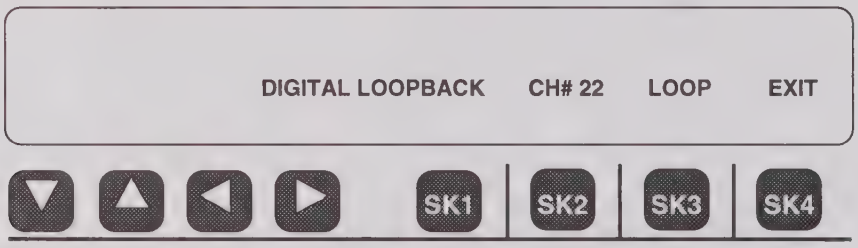
After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **57** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press **ENT** or any softkey to bring up the loopback selection display:

The default selection is **DIGITAL LOOPBACK**. Press softkey 1 to loopback digital patterns (511 or 2047 bit long patterns). Press softkey 3 under **VF LOOPBACK** if tones (1004 Hz) are being sent.

6-57.1 Digital Loopback

If you selected **DIGITAL LOOPBACK**, you will advance to the following screen:



In the above example, Channel 22 (**CH# 22**) has been looped back. (Select a channel between **1** and **24** under **PCM** Trunk Type. See **Section 5, PCM Operation** for set-up information.) To initiate a loopback, press softkey 3 under **LOOP**. A cursor will appear over **LOOP** indicating that the selected channel has been looped back.

Press softkey 3 under **LOOP** to discontinue the loop. Press softkey 4 under **EXIT** to take down the loop and return the 930A to the main display. Note that only the selected channel is looped. The other 23 channels pass through unimpaired.

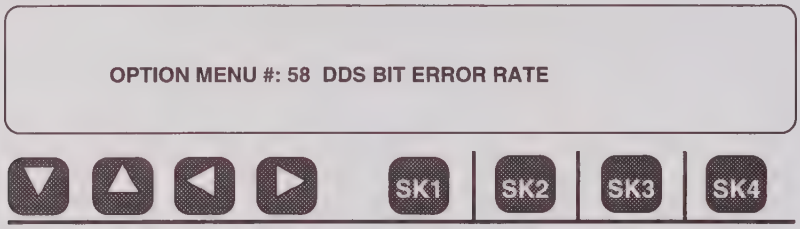
6-57.2 VF Loopback

If you select **VF LOOPBACK**, you will advance to the following screen:

You may insert gain or attenuation. The default is **0 dB.** The valid parameters are between **-40 dB** and **+2 dB**. Press softkey 1. Use the numeric keypad to enter the value. In the above example, Channel 22 (**CH# 22**) has been looped back. (Select a channel between **1** and **24** under **PCM** Trunk Type. See **Section 5, PCM Operation** for set-up information.) To initiate a loopback press softkey 3 under **LOOP**. A cursor will appear over **LOOP** indicating that the selected channel has been looped back. The VF Loopback also retains the companding algorithm which is suspended during a digital loopback.

Press softkey 3 under **LOOP** to discontinue the loop. Press softkey 4 under **EXIT** to take down the loop and return the 930A to the main display. Note that only the selected channel is looped. The other 23 channels pass through unimpaired.

6-58 OPTION MENU #: 58 DDS BIT ERROR RATE



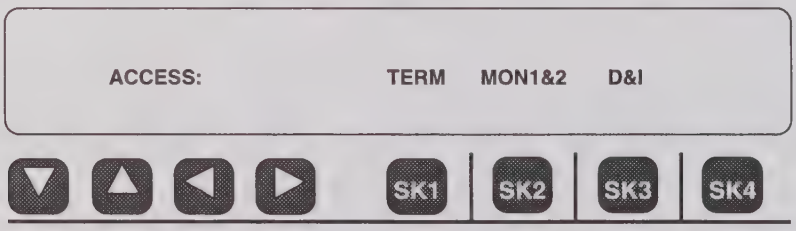
The following describes operation of T1 access DDS functionality in the 930A.

6-58.1 Set-up

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **58** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press softkey 1 under **SET-UP**:

The PCM set-up provides access and framing selection, which may be different than the set-up in Trunk Type in the main PCM menu. Press softkey 1 under **PCM**. The following screen will be displayed:



Press softkey 1, 2 or 3 as appropriate. If **TERM** is selected, you will advance to the **FRAMING** display. If **MON1&2** or **D&I** is selected, the test direction must be selected before the **FRAMING** type.

The following screen is displayed:

Select softkey 3 or 4 as appropriate. You will advance to the **FRAMING** set-up display:

Select the appropriate framing type. You will be returned to the main **SET-UP** display. Press softkey 2 under **CHANNEL** to see:

The following subsections will show displays depending upon your selection from the previous **ACCESS** display:

6-58.1.1 SW56 or 64KB Access

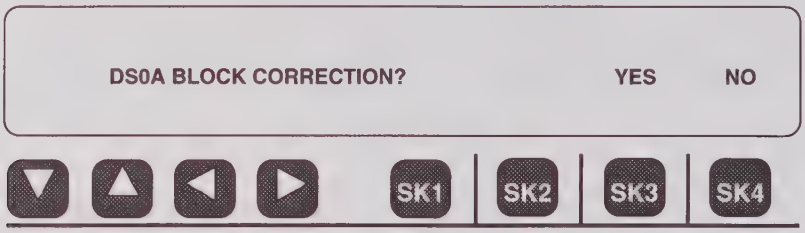
Select **SW56** or **64KB** to see:

Use the numeric keypad to change the channel number. Press softkey 2 to toggle from **RECV-1** to **RECV-2**. Press softkey 4 under **EXIT** to return to the main **SET-UP** display.

6-58.1.2 DS0A Access

Select **DS0A** to see:

Use the numeric keypad to change the channel number. Press softkey 2 to toggle from **RECV-1** to **RECV-2**. Press softkey 3 to scroll through the various baud rates. Valid rates are **56KB, 2.4KB, 4.8KB, 9.6KB** and **19.2KB**. Press softkey 4 under **MORE** to see:



Press softkey 3 under **YES** to have the receiver perform the DS0A "voting" error correction algorithm on the received data before comparing it with the expected pattern to detect errors. Press softkey 4 under **NO** to use the first sample received.

6-58.1.3 DS0B Access

Select **DS0B** to see:

Use the numeric keypad to change the channel number. Press softkey 2 to toggle from **RECV-1** to **RECV-2**. Press softkey 3 to scroll through the various baud rates. Valid rates are **2.4KB, 4.8KB,** and **9.6KB**. Press softkey 4 under **MORE** to see:

Enter the desired channel from the numeric keypad. The channel number under test is dependent upon your baud rate selection. For **2.4KB**, the valid channels are from **1** to **20**. For **4.8KB**, the valid channels are from **1** to **10**. For **9.6KB**, the valid channels are from **1** to **5**. Press softkey 4 under **EXIT** when complete. You will be returned to the main **SET UP** menu.

6-58.1.4 Channel Selection

Press softkey 3 under **TEST**:

Press softkey 1 to test the Primary Channel or Primary and Secondary Channels. You will see:

The default selection is **PRI&SEC**. Notice the flashing cursor above softkey 3. Select softkey 1 for **PRIMARY ONLY** or softkey 3 for **PRI&SEC**. You will be returned to the previous **SELECT** menu.

6-58.1.4.1 Pattern Selection

Press softkey 2 under **PATTERN**:

The default pattern is **511**, with a **CONTINUOUS TEST** time parameter. Press softkey 1 or the Up/Down arrow keys to scroll through the pattern choices.

The following patterns are available:

511
2047
2↑15
2↑20
2↑23
DDS-1
DDS-2
DDS-3
DDS-4
DDS-5
USER

The following test durations are available:

CONTINUOUS
15 MINUTE TEST
1 HOUR TEST
24 HOUR TEST

Press softkey 2 or 3 to scroll through the test durations. Press softkey 4 under **EXIT** when the pattern and test duration parameters have been chosen. If you selected the **USER** pattern, the next display allows you to enter any 8 bit pattern of 1s and 0s.

The 1:7 and USER patterns are invalid for Alternating Loopback testing.

Press softkey 4 under **MORE** to return to the previous **SELECT** menu.

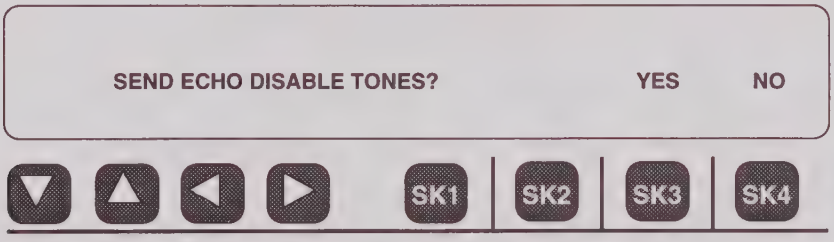
If you previously selected **PRI&SEC** as the channel selection, pressing softkey 4 under **MORE** displays the Secondary Channel pattern. The following screen is displayed:

Valid secondary channel patterns are **63, 511** and **2047**. Press softkey 1 or the Up/Down arrow keys to scroll through the pattern selections. Press softkey 4 under **MORE** to return to the **SELECT** screen.

6-58.1.4.2 Echo Canceller

Echo Canceller is only available in **SW56, 64KB** and **DS0A** modes.

Press softkey 3 under **ECHO-CNCL**:



Press softkey 3 to send the 2100 Hz disable tone. Press softkey 4 to discontinue this function. You will be returned to the previous **SELECT** menu. Press softkey 4 under **EXIT** or the **Option Menu** function key to return to the main **SET-UP** menu.

Press softkey 4 under **EXIT** or the **Option Menu** function key to return to the main **SELECT** menu.

6-58.2 Testing

Press softkey 2 under **TEST**:

If either **DS0A** or **DS0B** was previously selected from the **CHANNEL** display, the above screen will show the access channel number followed by a colon and the subrate channel. For example, **CH#22:01**.

The error results are displayed above softkey 1. Press softkey 1 or the Up/Down arrow keys to scroll through the available tests:

BIT ERRS	(BIT ERRORS)
BER	(BIT ERROR RATE)
BPV ERRS	(BIPOLAR VIOLATION ERRORS)
BPVR	(BIPOLAR VIOLATION RATE)
FR ERRS	(FRAME ERRORS)
FR LOSS	(FRAME LOSS)
BIT SLIP	
FR SLIP	(FRAME SLIP)
SLS	(SYNC LOSS SECONDS)
EFS	(ERROR FREE SECONDS)
%EFS	
ES	(ERRORED SECONDS)
%ES	
SES	(SEVERELY ERRORED SECONDS)
%SES	
FAILED	
%FAILED	
AVAIL	
%AVAIL	
UNAVAIL	
%UNAVAIL	
ELAPSED	
DS0A BLK	(DS0A BLOCK ERRORS)
DS0B FRM	(DS0B FRAME ERRORS)

If **MON1&2** was selected previously, bit errors and BER are not displayed. The following errors are substituted for error count if pattern synchronization is not achieved.

NO PCM
FRAME LOSS
NO PATTERN SYNC
YELLOW ALARM
NO DS0A SYNC
NO DS0B SYNC

Press softkey 2 under **PRI-RCV1**. If you selected **PRIMARY ONLY** from the channel selection screen previously, you will see:

If you selected **PRI&SEC** from the channel selection screen previously you will see:

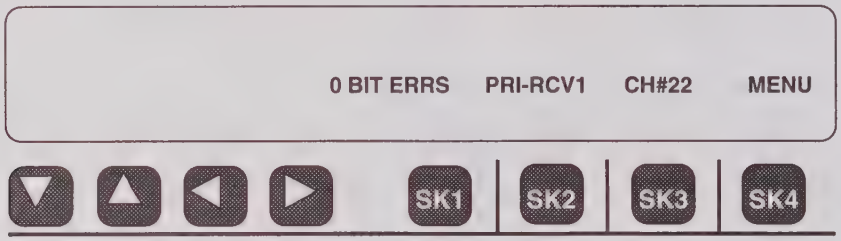
RECV-2 (above softkey 4) applies only if **MON1&2** or **D&I** mode was selected from the **PCM SET UP** display. If you selected **TERM** mode, **RECV-2** is not available.

If the source is **PRIMARY** only (in the first display above), press softkey 3 or 4 to change sides.

To change the source from **PRIMARY** to **SECONDARY** (in the second display above), press softkey 2.

Pressing any softkey will display: **WILL RESTART TEST - CONT? YES NO**. Press softkey 3 or 4 accordingly.

If you changed sources or sides, the test screen reflects this change above softkey 2. To re-enter the **SOURCE** screen, press softkey 2. Each time a source or side is changed, the above prompt will display. You will be returned to the test display:



Press softkey 3 under **CH#**:

The far left of the display shows the channel type previously selected. If the channel type is DS0A, the baud rate originally selected is also displayed. You may change the access channel number originally selected from the **CHANNEL** menu. Use the numeric keypad. Press **ENT**.

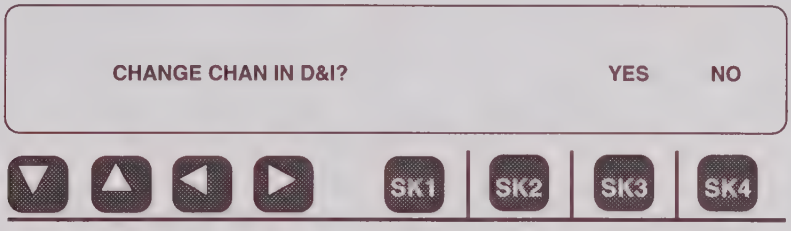
If the channel type is DS0B, the display will show the channel type, baud rate, access channel number and subrate channel number:

You may change the access channel number or the subrate channel number originally selected from the **CHANNEL** menu. Press softkey 1 or 2 to change the access channel. Use the numeric keypad to enter a channel between **1** and **24**. Press softkey 3 to change the subrate channel number.

For **2.4KB** baud rate, the valid channels are from **1** to **20**. For **4.8KB** baud rate, the valid channels are from **1** to **10**. For **9.6KB** baud rate, the valid channels are from **1** to **5**. Enter the new value from

the numeric keypad or us the Up/Down arrow keys.

If any channel change is given while in **D&I**, a warning screen will be given:



Pressing softkey 3 under **YES** will make the channel change and leave the unit in **D&I**. Pressing softkey 4 under **NO** will allow the 930A to proceed with no change. You will be returned to the previous display.

Press softkey 4 under **EXIT** when complete. You will be returned to the test display.

6-58-2.1 Multijunction Port Configuration

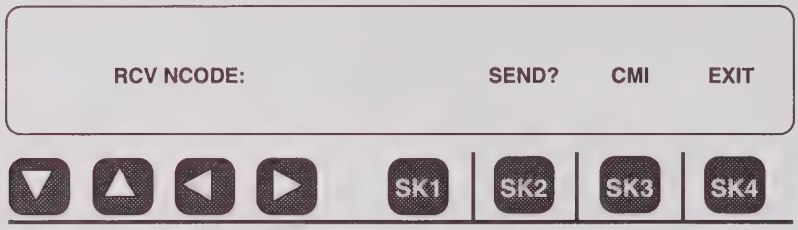
For specific information on multijunction port configurations, refer to Bellcore Document TR-SY-000476.

Press softkey 4 under **MENU**:

LPBACK is displayed above softkey 2 in all modes except **64KB** mode. **NETWORK** is displayed above softkey 1 in **DS0A** and **DS0B** only. This allows access to the network configuration code (**NET-CODE**) menus and the multiport junction unit (**MJU**) configuration menus. If in **DS0A** or **DS0B**, press softkey 1 under **NETWORK**:

6-58.2.1.1 Net-Code

NET-CODE allows a network configuration code to be sent and received. If in **TERM** or **MON1** mode, press softkey 1 under **NET-CODE** to see:



Press softkey 3 to scroll through the valid network configuration codes. The following codes are available:

CMI
TEST
OOS
UMC
ASC
LAT-LDN
MJU-SEL
MJU-RES
MJU-BLK
MJU-UNB
MJU-REL
MJU-LBK
MJU-LDN

After pressing softkey 2 under **SEND?**, the display will change to **SEND!** indicating the network code selected above softkey 3 is being sent. Press softkey 2 again to discontinue sending. The left portion of the display shows any valid network configuration code received.

If in **D&I** or **MON1&2** mode, you will see the following screen:

The results from side 1 (**RECV-1**) or side 2 (**RECV-2**) will display above softkey 3, depending on which side is being tested.

Press softkey 4 under **EXIT** to return to the test screen:

Press softkey 4 under **MENU**. The following screen is displayed:

Press softkey 1 to select the **NETWORK** mode again:

6-58.2.1.2 MJU-CFG

Press softkey 3 to select **MJU-CONF**. This function displays the multiport junction unit configuration menus, the first of which follows:

Selecting **MORE** will scroll through two more MJU menus. Press softkey 3 under **MORE** to see:

Press softkey 3 under **MORE** to see:

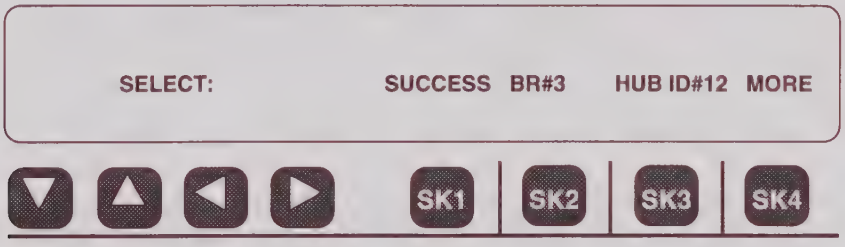
Press softkey 3 under **MORE** to return to the first MJU menu.

6-58.2.1.2.1 Select

Press softkey 1 under **SELECT**:

Press softkey 1 or the Up/Down arrow to scroll through the four possible Branch numbers. Press softkey 3 to **SEND** the required Branch select command. The display will read **SENDING...**

If the select process was successful, the display will show the result and returned HUB number. For example:



If the outcome was unsuccessful, the display will show:

In either case, pressing softkey 4 under **MORE** will return you to the main MJU menu:

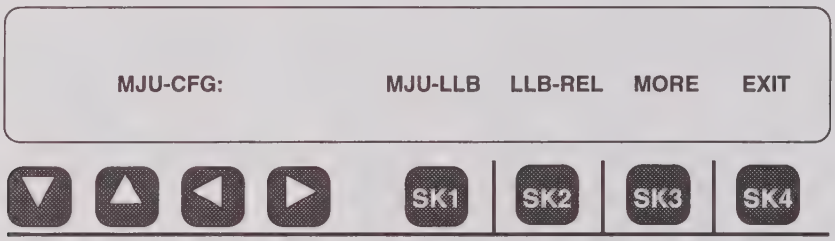
6-58.2.1.2.2 Release

Press softkey 2 under **RELEASE** to see:

You will be returned to the main MJU menu.

6-58.2.1.2.3 More

Press softkey 3 under **MORE** to see:

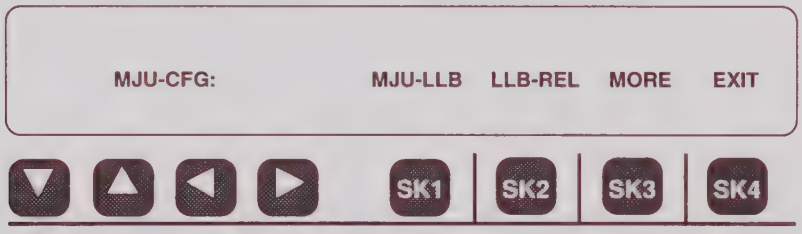


Press softkey 1 to send the latched loopback command. The display will read: **MJU-LLB: SENDING LOOPBACK CODE...** If the loopback was successful, the display will show the result and returned HUB number. For example:

If the loopback was unsuccessful, the display will show:

In either case, pressing softkey 4 under **MORE** will return you to the previous MJU menu:

Press softkey 2 under **LLB-REL** to release the latched loopback code. The display will read **SENDING LOODOWN CODE...** You will be returned to the previous MJU menu.



Press softkey 3 under **MORE** to see the last of the MJU configuration menus:

Press softkey 1 under **BLOCK**.

If you have not selected a branch from the previous submenu, you will see the alert message **MUST SELECT BRANCH FIRST**. Press softkey 4 under **MORE** to return to the previous menu. Otherwise, you will see:

followed by:

or:

In either case, press softkey 4 under **MORE** to return to the previous MJU menu. The **UNBLOCK** submenus are identical to the **BLOCK** submenus. These functions are required to clear the MJU Branch Block.

Press softkey 4 under **EXIT** to return to the test screen. Press softkey 4 under **MENU** to return to the **SELECT** menu:

Press softkey 2 under **LPBACK** to see:

Press softkey 2 for **LOOP-UP** function. The following screen is displayed:

Use softkey 1 or the Up/Down arrow keys to scroll through alternating and latching loopback codes. The following loopback codes are provided:

ALTERNATING CODES

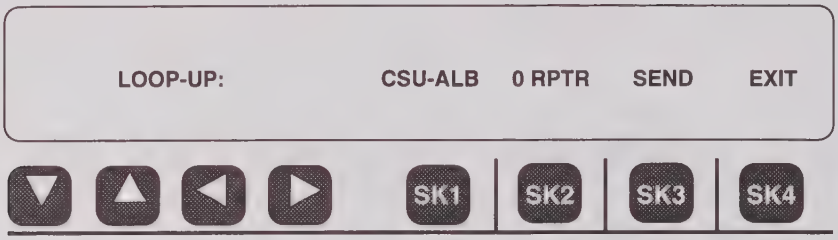
DSU-ALB	Data Service Unit-Alternating Loopback
CSU-ALB	Customer Service Unit-Alternating Loopback
56KB-RPT	
OCU-ALB	Office Channel Unit-Alternating Loopback
OCU-HL96	
HL96-ALB	

LATCHING CODES

DS0DP	DS-0 Data port
HL222-LLB	
OCU-LLB	Office Channel Unit-Latching Loopback
CSU-LLB	Customer Service Unit-Latching Loopback

The following two loopback codes require additional information before sending.

CSU-ALB:



Pressing softkey 2 selects the number of 56Kb repeaters in the line between the CSU and the serving office. The default value is **0** with a valid range from **0-2**.

DS0DP:

The number of intermediate units when latching a DS0DP must be selected. Use softkey 2 to scroll through the units. The default value is **0** with a valid range from **0** to **7**.

In all cases, when the desired code has been selected, press softkey 3 under **SEND**.

If you selected an ALB code, the display will read **ESTABLISHING LOOP....** If you selected an LLB code or DS0DP code, the display will read **SENDING LOOP UP CODE...**

Different codes have different establishment or send times, varying from approximately 1 to 7 seconds. Loopback success determination differs depending on the loop code sent.

After sending a loop-up code, you will be returned to the test screen.

To send the loop-down code, press softkey 4 under **MENU** and softkey 2 under **LPBACK** to return to the following screen:

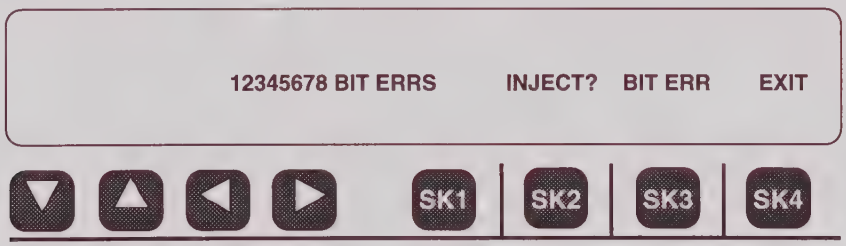
Press softkey 3 to send loop-down sequence. If SW56 testing was selected, only V.54 is the valid loop code.

If you selected an ALB code, the display will read **LOOP CODES STOPPED...** If you selected an LLB code or DS0DP code, the display will read **SENDING LOOP DOWN CODE...**

After sending a loop-down code, you will be returned to the test screen.

To inject errors, press softkey 4 under **MENU** to see:

Press softkey 3 under **INJ-ERR** to see a display similar to:



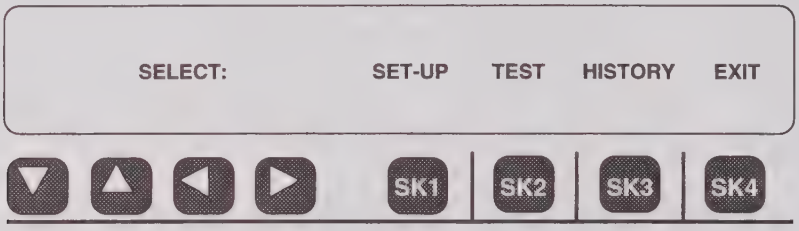
Softkey 3 scrolls through the available error displays.

For all modes, the valid errors are **BIT ERR** and **6 BIT ERR**. In DS0A mode, the valid errors include **DS0A 2:5** and **DS0A 3:5**. In DS0B mode, the valid errors include **DS0B FRM** (framing bit).

Press softkey 2 under **INJECT** to inject the error selected above softkey 3. Press softkey 4 under **EXIT** to return to the test menu.

Press the **Option Menu** function key to return to the main **SELECT** menu.

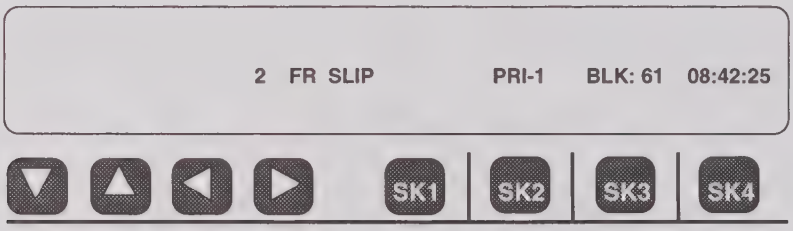
6-58.3 History



To review the errors which have been recorded, press softkey 3 under **HISTORY**. If no tests have been made, you will see the message **NO BERT HISTORY AVAILABLE**. Otherwise, you will see:

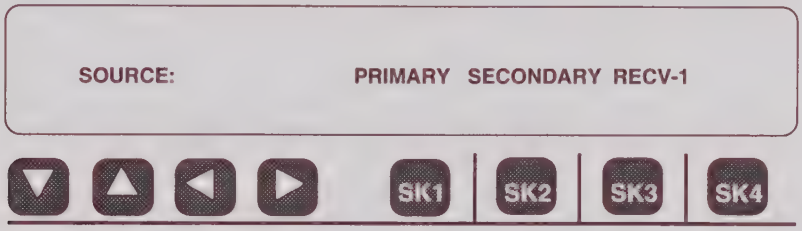
6-58.3.1 View

To view test results on the 930A front panel, press softkey 2 under **VIEW**. You will see a display similar to:

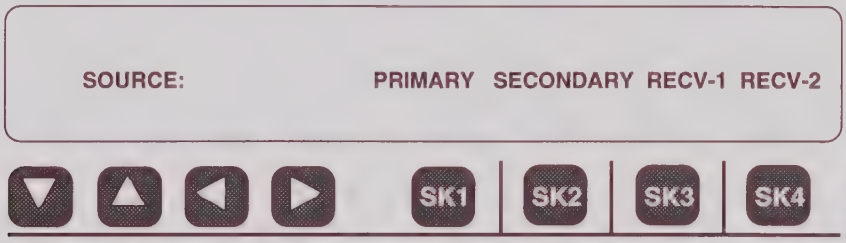


The above display shows the 61st 15-minute block of time since the test began. To find out what has gone on over this time period, press softkey 3 under **BLK: 61**. The 930A display will begin at Block 1. Continue pressing softkey 3 to scroll through the remaining 60 blocks. Note that the time above softkey 4 changes with each block.

If you selected **PRI&SEC** channel source, pressing softkey 2 will toggle to between **PRI-1** and **SEC-1**, displaying the results for each. If the Secondary Channel is not being tested, only the **PRIMARY** results are valid. Depending upon your selections, you will see a display similar to:



The above display reflects **TERM** mode.
If the 930A is in **MON1&2** or **D&I**, you will see:



Press softkey 1 or 2 to view results on the **PRIMARY** or **SECONDARY** channel accordingly. You will be returned to the **RESULTS** screen.

Press softkey 2 under the channel selection to return to the above display. Press softkey 3 or 4 to view results on the appropriate side.

Press softkey 1 or the Up/Down arrow keys to scroll through the remaining tests. Press the **Option Menu** function key to return to the main **SELECT** menu.

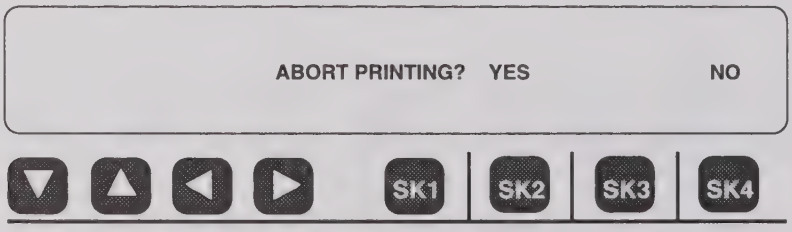
6-58.3.2 Print

If *Purchased Option 930A-10C, Remote Control Interface* is installed, you may connect a printer or computer to the 930A and view the results via terminal or printout. See **Section 7, Remote Control Operation** for instructions on connecting a printer or computer to your 930A. To print out the results to date, press softkey 3 under **HISTORY**. Press softkey 3 again under **PRINT.** You will see:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be printed. If you press softkey 3 under **ALL**, every test in every block will be printed. Press softkey 1 under **RANGE** to specify the number of blocks you wish to print. The compilation of 96 15-minute blocks may be printed. You will see:

The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be printed. Press softkey 3 under **PRINT** when complete.

To abort printing, press any softkey or the Option Menu function key to see the screen below.



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

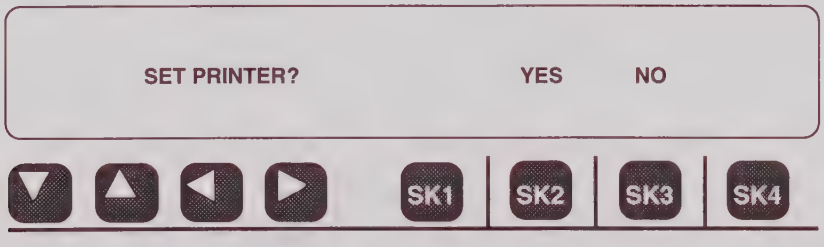
If you select nothing, you will be returned to the **PRINT** screen:

Press softkey 4 to exit this menu or the Option Menu function key to return to the top level menu. You will see:

Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

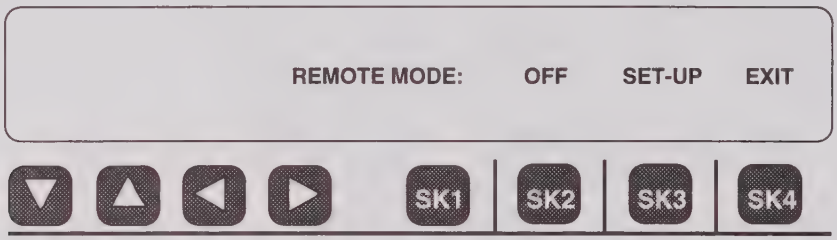
6-58.3.2.1 Not In Printer Mode

If you have not set the 930A to **PRINTER, COMPUTER** or **TERMINAL** mode (via **OPTION MENU #: 3 REMOTE CONTROL**) you will see a brief message **NOT IN PRINTER MODE!** and then the display:



Press softkey 3 under **NO** to discontinue the set-up procedure. You will be returned to the previous screen.

To set the parameters for your printer, press softkey 2 under **YES** to advance to the **REMOTE MODE** display:

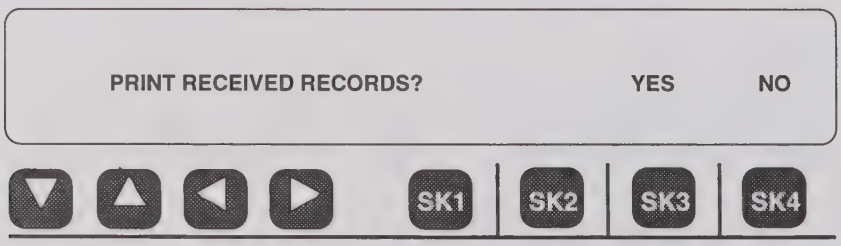


Press softkey 2 under **OFF** to scroll through the available remote options. Press softkey 3 under **SET-UP** to set the baud rate, parity and bit #. Refer to **Section 6-3, Remote Control** for set-up instructions.

After completing the **SET-UP**, press softkey 4 under **EXIT**. The 930A will advance to a series of questions regarding printing parameters. To bypass these displays, press the **Option Menu** function key to return to the main **PRINT** menu.

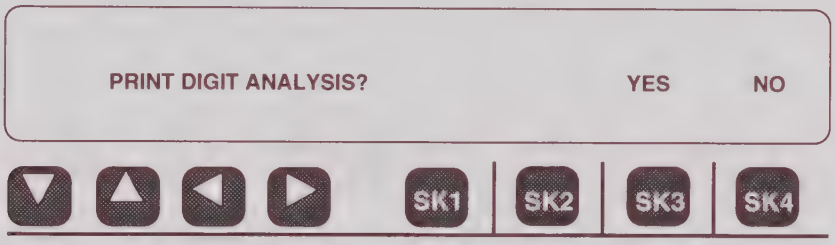
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT ERRORS**?

To send PCM errors, press softkey 3 under **YES**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:



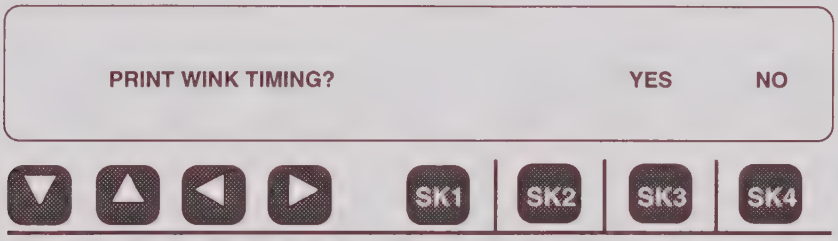
If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT RECEIVED RECORDS**?

To send calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4. Selecting **YES** displays the following screen. Selecting **NO** skips the following screen:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT DIGIT ANALYSIS**?

To send the analysis of the received digits, press softkey 3 under **YES**, otherwise press softkey 4. The 930A display advances to:



If **COMPUTER** or **TERMINAL** mode is chosen, the previous screen reads **REPORT WINK TIMING**?

To send the wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A will exit the Option Menu. The printer will begin to print whenever one of the conditions occurs, or whenever the **ENT** key on the 930A is pressed.

Press the **ENT** key to test your connection. If the output is garbled, adjust the baud rate, parity, or number of bits. To suspend printing for any reason without taking the 930A out of Printer mode, turn off the printer.

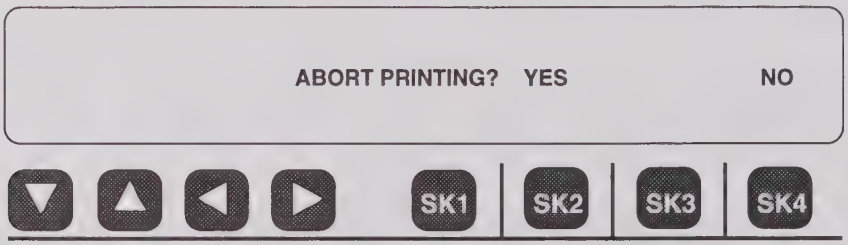
> *Taking the printer off-line instead of turning off the power may not have the desired effect. The printer buffer may fill up with unwanted material which will be printed out when the printer is placed back on-line.*

You will be returned to the **PRINT** menu:

If you press softkey 2 under **TOTAL**, the accumulated total of errors in each block will be printed. If you press softkey 3 under **ALL**, every test in every block will be printed. Press softkey 1 under **RANGE** to specify the number of blocks you wish to print. You will see:

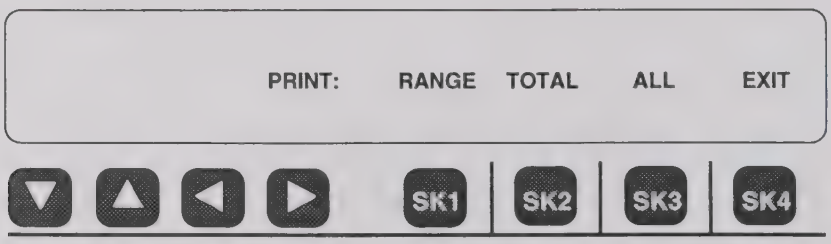
The default will show **1 TO <largest block number>.** To change the block number parameters, press softkey 1 for the beginning block number and/or softkey 2 for the ending block number. Enter the valid number with the numeric keypad. The compilation of 96 15-minute blocks may be sent. Press softkey 3 under **PRINT** when complete.

To abort printing, press any softkey or the **Option Menu** function key to see the screen below.



If you press softkey 1 or 2 under **YES**, you will see the message **FINISHING CURRENT BLOCK BEFORE ABORT**. If you press softkey 3 or 4 under **NO**, printing will resume.

If you select nothing, you will be returned to the **PRINT** screen:



Press softkey 3 under **TOTAL** to send the accumulated total of errors in each block. Press softkey 4 under **ALL** to send every test in every block. Press softkey 4 to exit this menu or the **Option Menu** function key to return to the top level menu. You will see:

Press softkey 4 under **NO** to continue within this option or softkey 3 under **YES** to end (interrupt). You will be returned to the main display.

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6-65 OPTION MENU #: 65 GND-ST COIN PHONE

Set the 930A Trunk Type to the appropriate Ground Start trunk settings. See **Section 4, Analog Operation** for set-up information.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **65** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection.

If the 930A is not in Ground Start mode the display will read **NOT APPLICABLE**. Otherwise, you will see:

Press Softkey 2 under **YES** to put the 930A in the coin phone mode. The 930A functions and menu options continue to operate as usual.

Press the **Option Menu** function key to exit this option.

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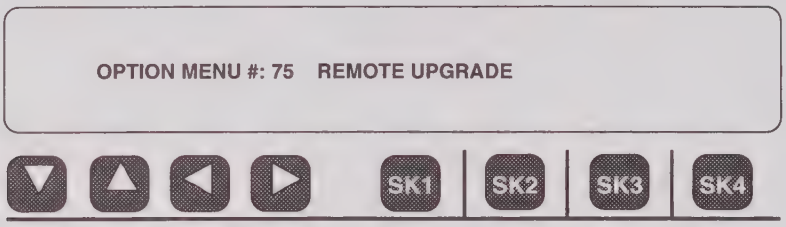
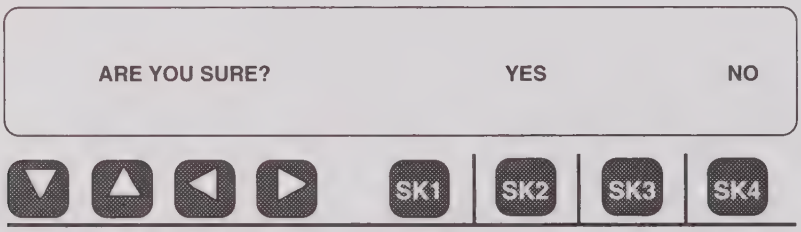
6-75 OPTION MENU #: 75 REMOTE UPGRADE



This option is used to download software to the 930A via computer. The 930A must be in **COMPUTER** or **TERMINAL** remote mode for this option to function correctly. Refer to **OPTION MENU #:3 REMOTE CONTROL** for set-up information.

After completing the initial set-up for the 930A, press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **75** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press softkey 4 under **NO** to discontinue the remote upgrade process. To proceed with the upgrade, connect a 25-pin, RS-232 connector from the COM1 port on your PC to the RS-232C port on the rear panel of the 930A. Refer to **Section 7, Remote Control Operation** for further information. Press softkey 2 under **YES** to proceed. You will see:



The default is **NO**; the cursor is flashing over this selection. Press softkey 4 to discontinue the upgrade process. Press softkey 2 under **YES** to proceed. If you have not made the proper connections, you will see the message **FIRMWARE UPDATE -- WAITING FOR CONNECT**.

The 930A will cold-boot if it does not receive any communication within one minute!

Refer to the instructions accompanying your software upgrade diskette for information regarding interaction with your PC.

If the downloading procedure is interrupted, turn off the 930A, hold down the **ENT** and **HELP** keys and turn the 930A on again. You will return to this option menu number.

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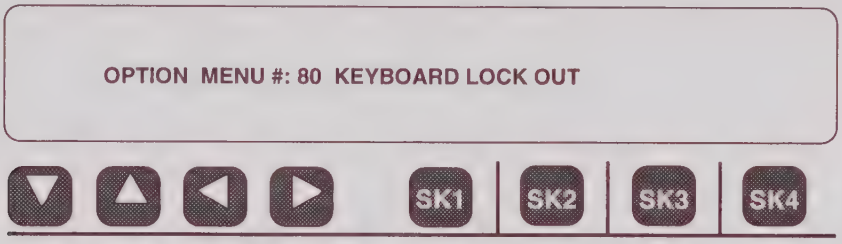
6-80 OPTION MENU #: 80 KEYBOARD LOCK OUT



Blocking out all keys on the 930A front panel allows only **REMOTE** mode to affect the 930A.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **80** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press softkey 4 under **NO** to discontinue this procedure. Press softkey 2 under **YES** to lock out all keys on the 930A front panel.

If any key is pressed while in the lock-out state, the 930A will display **KEYBOARD LOCKED! 9999 TO UNLOCK**. To return the 930A to normal functionality, press **9999** on the numeric keypad.

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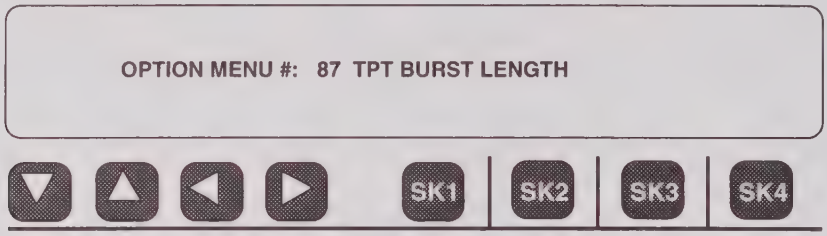
6-87 OPTION MENU #: 87 TPT BURST LENGTH



This option allows the user to set the length of the TPT tone sent from the 930A when acting as a Type 105 responder. This affects **OPTION MENU #: 25 FAR END RESPONDER** and **OPTION MENU #: 4 DIGIT RECEIVER**. This feature allows the 930A to be compatible with most near-end responders.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **87** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

The valid range is between **.01 SEC** and **99.9 SEC**. The default parameter is **2.5 SEC**. Press softkey 4 under **EXIT** or the **Option Menu** function key to exit this display.

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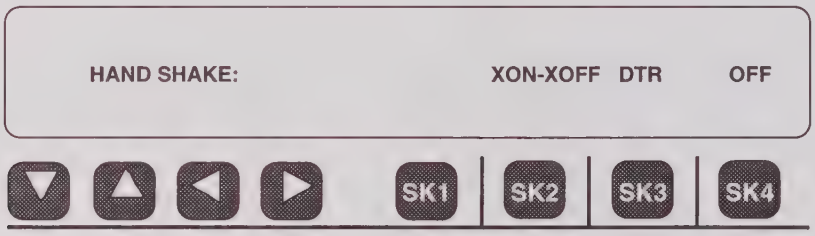
6-89 OPTION MENU #: 89 PRINTER HAND SHAKE

This option allows you to select a form of flow control when the 930A sends data to the printer. This allows the printer to tell the 930A to stop sending when the printer's buffer is full or the printer is off-line.

If your printer misses characters sent by the 930A, especially during long printouts such as digit analysis or T1 BERT history, select a lower baud rate or use **OPTION MENU #: 89 PRINTER HAND SHAKE** to output data at the greatest efficiency. The 930A supports DTR and XON/XOFF protocols.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **89** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



The factory default is **OFF** (no hand shake). Press softkey 4 under **OFF** to allow the 930A to send to any serial device.

Press softkey 3 to enable **DTR** handshaking. This allows the 930A to send characters to the printer only when it sees positive voltage on DTR (pin 20). If your printer is off-line, powered down, or has a full buffer, it will not provide this voltage and the 930A will "hang" when attempting to print. DTR handshaking allows the printer to "catch up" by printing the contents of its buffer while the 930A waits. The printers supplied by Sage Instruments are shipped with DTR handshaking enabled.

Press softkey 2 under **XON-XOFF** to enable the 930A to stop sending characters to the printer when it receives the XOFF character (**CNTL-S**) from the printer. It will resume sending characters when it receives the XON character (**CNTL-Q**). XON-XOFF protocol is useful when communicating over modems or other media which do not allow a separate hardware hand shake, such as the DTR line.

When the 930A attempts to send characters and the hand shake fails (there is no voltage on DTR or an XOFF character was received without an XON), it "hangs" until either the hand shake succeeds or 10 seconds have passed. If 10 seconds pass without a successful hand shake, the 930A turns the hand shake **OFF** and proceeds normally. If a hand shake fails because a printer is turned off or left off-line when the 930A needs to print, you will need to re-enable the hand shake by using **OPTION MENU #: 89 PRINTER HAND SHAKE** again. As long as the hand shake is successful, the hand shake protocol is stored in battery-backed RAM and will remain set.

6-90 OPTION MENU #: 90 DSP MEMORY TEST

This option requires *Purchased Option 930A-01, Digit Receiver*. The DSP memory test checks the health of the memory on the DSP board in the 930A. If you get strange test results in the digit receiver/analyzer and the 930A has been cold-booted, this option may be used as a diagnostic tool.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **90** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If all is well, the following screen will display:

If the 930A shows anything other than the above display, call Sage Instruments Customer Service at (408)761-1000.

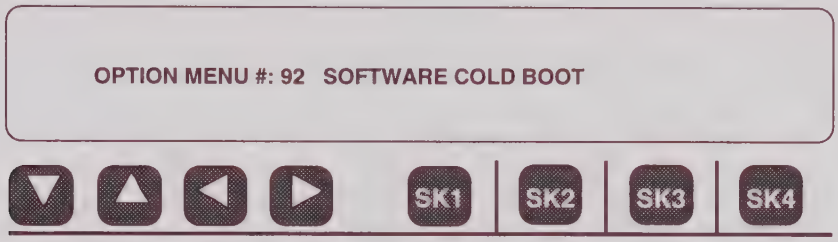
Press the **Option Menu** function key to exit this display.

6-91 OPTION MENU #: 91 SOFTWARE VERSION

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **91** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The 930A will display the software version installed:

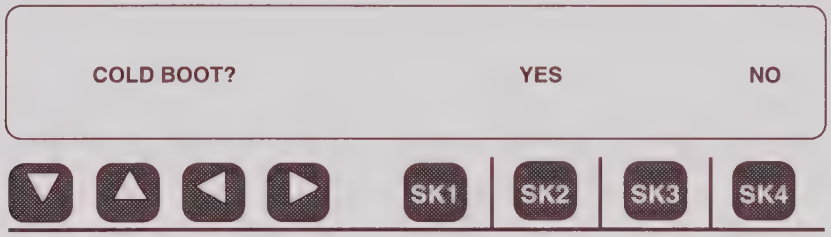
Press the **Option Menu** function key to exit this display.

6-92 OPTION MENU #: 92 SOFTWARE COLD-BOOT



This option restores the 930A to its factory default settings. Selecting this option does not affect the Remote Control settings.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **92** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



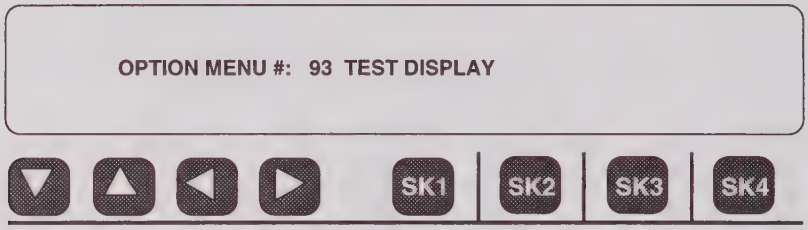
Press softkey 4 under **NO** to discontinue the cold-boot process. Press softkey 2 under **YES** to cold-boot the 930A.

WARNING!

Cold-booting the 930A will erase all memories and restore all factory defaults. The 930A will return to the 2-WIRE LOOP START Trunk Type default.

NEVER SELECT YES WHEN THE 930A IS CONNECTED TO A CIRCUIT!

6-93 OPTION MENU #: 93 TEST DISPLAY

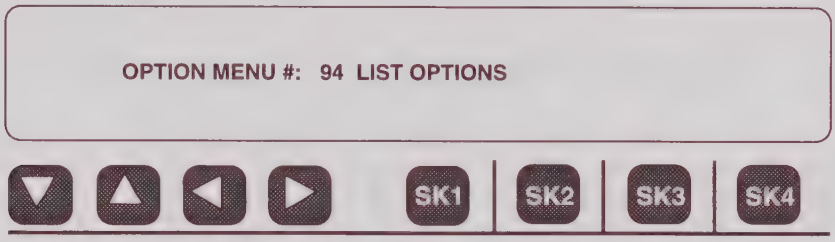


This option is used to test the display and the LEDs by turning everything on.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **93** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

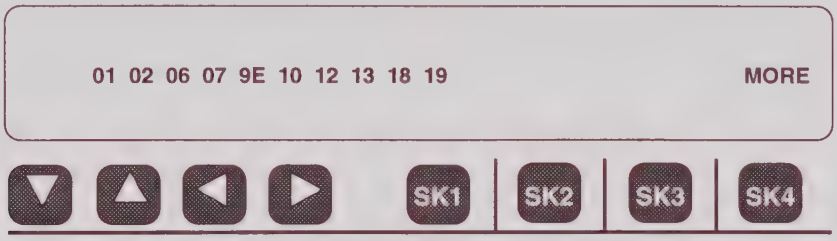
Press **ENT** or any softkey and all lights and LEDs will go on. Press the **Option Menu** function key to exit this test.

6-94 OPTION MENU #: 94 LIST OPTIONS



This option lists what *Purchased Options* are installed in your 930A.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **94** via the numeric keypad. In either case, press **ENT** or any softkey to see a display similar to:



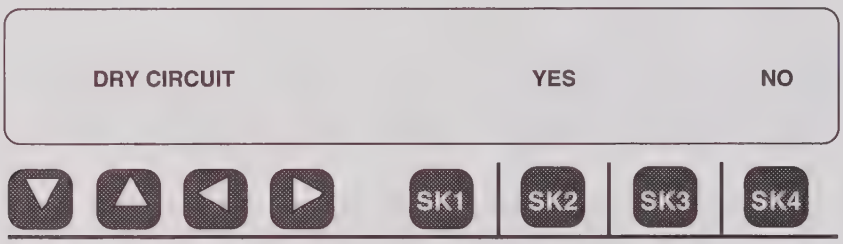
Press softkey 4 under **MORE** to display any further *Purchased Options* :

Press softkey 4 under **EXIT** to return to the main display.

6-95 OPTION MENU #: 95 DRY CIRCUIT

The 930A normally expects to see supervision on the trunks it is testing. Dry circuits are trunks that have no supervision. These are usually dedicated lines found in special services point-to-point applications. **OPTION MENU #: 95 DRY CIRCUIT** puts the 930A in the mode that tests these circuits.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **95** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



Press softkey 2 under **YES** to bring 930A to Dry Circuit mode in the Trunk Type menu:

The default parameters are shown above. Press softkey 2 to toggle **BRIDGE** to **TERM** (terminate). Press softkey 4 to scroll through the available impedances. The valid parameters are **2W 150, 600, 900, 1200,** or **4W 150, 600, 900, 1200**.

After setting the correct operating conditions, the 930A functions as it would in any other Trunk Type.

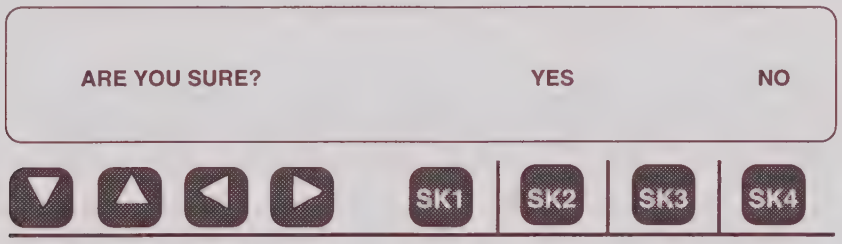
Press softkey 1 to exit this Trunk Type and remain in Trunk Type selection mode. Once the Trunk Type is changed, Dry Circuit mode is disabled. You must re-enter this option to enable Dry Circuit mode again. If the Trunk Type selection does not change, the 930A remains in Dry Circuit mode until this option is re-entered and softkey 4 under **NO** (disable) is selected.

6-96 OPTION MENU #: 96 TEST EXTENDED RAM

This option requires *Purchased Option 930A-32, 64K RAM Expansion.*

The extended RAM test checks the health of the RAM board in the 930A. If you are missing data or losing call information, this option may be used as a diagnostic tool.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **96** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The 930A will display **CLEARS TEST MEMORY!** and prompts:



Press softkey 4 under **NO** to exit this option. Press softkey 2 under **YES** to see:

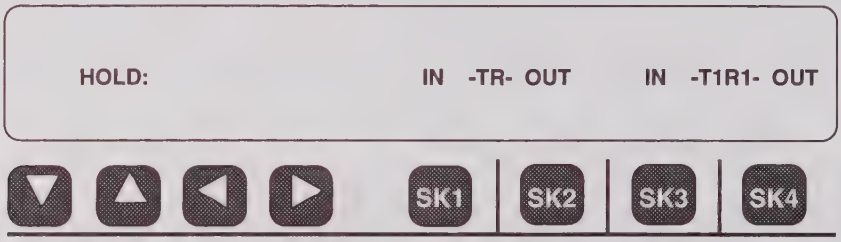
If the 930A shows anything other than the above display and *Purchased Option 930A-32* is installed, call Sage Instruments Customer Service at (408)761-1000.

Press the **Option Menu** function key to exit this display.

6-97 OPTION MENU #: 97 HOLD CONTROL

This option provides a path for DC current and allows the 930A to control one or both hold coils, or "hold the Central Office equipment up". This may be accomplished in 4-wire normal loop, 4-wire E&M, or dry circuit Trunk Types.

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **97** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:



The default settings are **OUT**. Press softkey 1 or 3 under **IN** to enable the hold coils. Testing may be performed with either TR **IN** or **OUT**, T1R1 **IN** or **OUT**, both **IN** or both **OUT**.

Press the **Option Menu** function key to exit this display.

6-98 OPTION MENU #: 98 ESF BOARD SOFTWARE VER

This option requires *Purchased Option 930A-08E, Single Direction ESF* or *-09E, Dual Drop/Insert w/ESF.*

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **98** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The 930A will display the ESF software version installed:

Press the **Option Menu** function key to exit this display.

7 REMOTE CONTROL OPERATION

7-0 INTRODUCTION

Remote Control operation of the 930A requires *Purchased Option 930A-10C, Remote Control Interface.* Through this Purchased Option, the 930A can be remotely controlled, or may itself control a printer through an RS-232C serial port located on the rear panel.

Remote Control operation requires a standard female 25-pin miniature "D" type connector (RS-232C). The mating male connector should be an Amp type 206771-1 or equivalent. Refer to **Figure 7-1** for the location of the serial port on the rear panel.

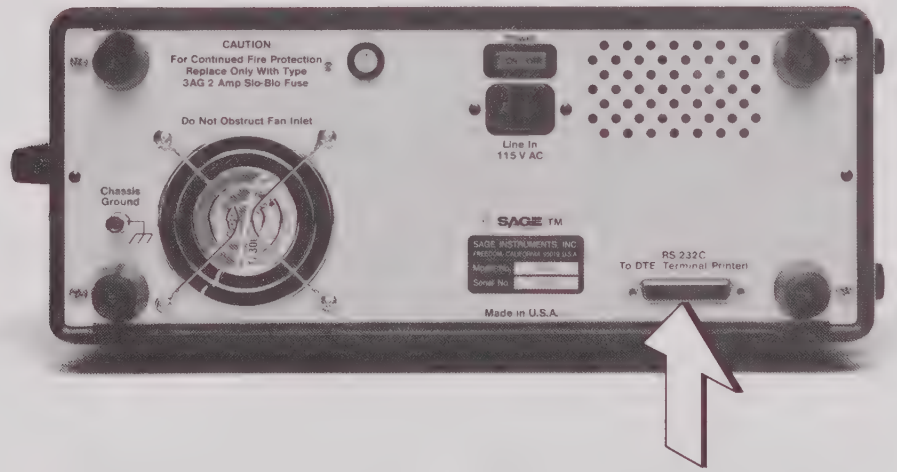
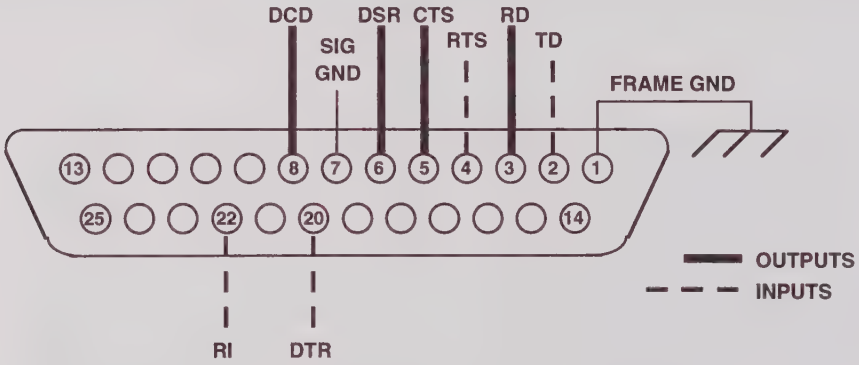


Figure 7-1
930A (AC) RS-232C CONNECTOR

7-0.1 Connections

The 930A works with most printers and terminals without modification to cables or reconfiguration of pins. The 930A serial interface is configured as Data Communication Equipment (DCE) and wants to "see" a Data Terminal Equipment (DTE) connection If your printer or computer has the capability of being either a DTE or a DCE, make sure that it is set to DTE emulation **before** connecting it to the 930A. If the equipment cannot be configured as DTE, it will be necessary to swap pins 2 and 3 (Transmit and Receive Data). This is accomplished by using a special cable known as a null modem cable, or by using a breakout box. The pinouts for the 930A connector are shown in **Figure 7-2**.



PIN	TO DTE	TO DCE	NAME	FUNCTION
1			FG	FRAME GROUND
2		→	TD	TRANSMITTED DATA
3	←		RD	RECEIVED DATA
4		→	RTS	REQUEST TO SEND
5	←		CTS	CLEAR TO SEND
6	←		DSR	DATA SET READY
7			SG	SIGNAL GROUND
8	←		DCD	DATA CARRIER DETECT
20		→	DTR	DATA TERMINAL READY
22	←		RI	RING INDICATOR

Figure 7-2
RS-232C CONNECTOR PINOUTS

The remaining 15 pins are not connected. The pinouts shown above connect directly to a DTE (Terminal) or printer.

Applying a voltage to pins 1 or 7 will cause damage to the 930A.

A null modem connection must be used for connection with a DCE terminal.

7.1 930A REMOTE CONTROL SET-UP

Press the **Option Menu** function key until the display reads **OPTION MENU #**. Press the Up/Down arrow keys to scroll through the option menus, or select **3** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. The following screen will display:

Press **ENT** or any softkey to see:

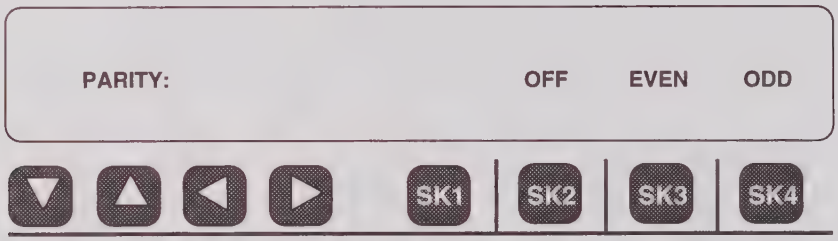
Press softkey 3 under **SET-UP** to see the display:

The above menu is used to adjust the baud rate, parity, and number of data bits of the 930A's asynchronous RS-232C serial interface to match the data format of any terminal, computer, or printer connected to the 930A. The settings are retained in non-volatile memory and need not be changed unless a new item of equipment is connected to the 930A.

To change the baud rate, press softkey 1 to see:

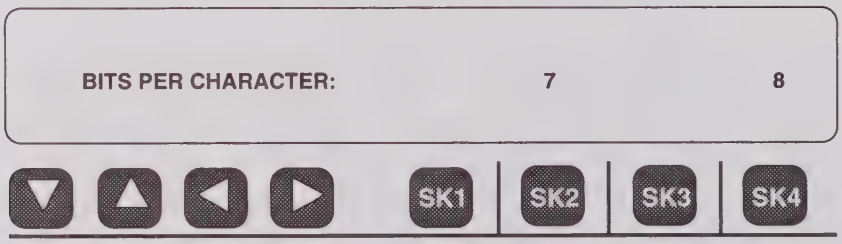
The valid range is from **300** to **38400**. The default value is **9600** baud. Use the numeric keypad to enter your selection. Press **ENT** or any softkey to exit this display. You will be returned to the **SELECT** menu.

To change the parity, press softkey 2 to see:



The default parity is **EVEN**. Press softkey 2 under **OFF** for no parity. Press softkey 3 for **EVEN** parity. Press softkey 4 for **ODD** parity. The 930A will revert to the **SELECT** menu.

To change the data format, press softkey 3 under **BIT#** to see:



The 930A supports ASCII data formats of 7 or 8 bits length. The default format is 7 bits per character. Some printers and terminals treat characters with bit 8 used as graphics characters.

Press softkey 2 to select **7** bits or softkey 4 to select **8** bits. The display will advance to:

The default stop bit value is **1**. Press softkey 2 to select **1** stop bit. Press softkey 3 to select **1-1/2** stop bits. Press softkey 4 to select **2** stop bits. One stop bit is the most common setting.

The 930A will return to the **SELECT** menu. Press softkey 4 to exit this display and return to the main **SET-UP** menu.

Press softkey 2 to scroll through the different remote modes. The following modes are listed:

OFF	Manual control (no remote control)
TERMINAL	For use with dumb terminals
MASTER	For future use
SLAVE	For future use
ATR	For future use
COMPUTER	For use under computer control
PRINTER	Used to drive a printer connected to the RS-232 serial port

After selecting a remote mode, pressing softkey 1 puts the 930A into **STANDBY MODE**. **REMOTE MODE** and **STANDBY MODE** will alternately flash on the screen until softkey 1 is depressed again, releasing **STANDBY MODE**. Use **STANDBY MODE** to operate the 930A manually without losing remote access capability.

The above modes are explained in detail in the following sections.

7-2 PRINTER MODE

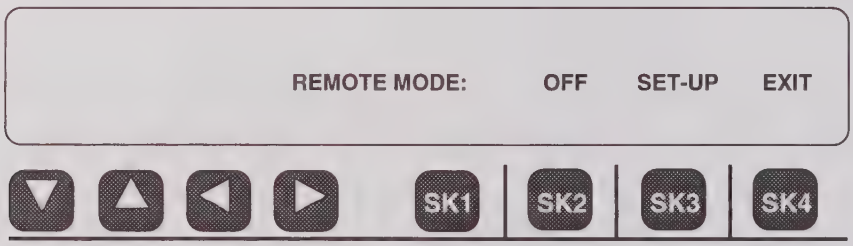
The 930A will work with most printers provided that the following conditions are met: The printer must have an asynchronous RS-232C serial input port; print both upper and lower case; be ASCII compatible; and have a carriage width of at least 50 characters (preferably 80 characters). For optimum performance, the printer should accept input at 9600 baud, have at least a 2K buffer, and accept continuous feed paper. Sage Instruments currently recommends the Okidata 182 with Super Speed Serial Interface. You may obtain this printer from Sage Instruments by purchasing accessory number *9400-0001-01, 80 Column Printer with Cable.*

Remote Control operation requires a standard female 25-pin miniature "D" type connector (RS-232C). The mating male connector should be an Amp type 206771-1 or equivalent. Refer to **Figure 7-1** for the location of the serial port on the rear panel.

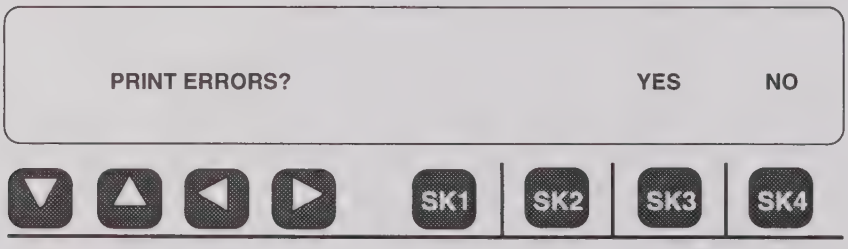
Use care with printers that do not have buffers. These printers must be run at a speed at, or below their print speeds multiplied by a factor of 10. That is, an unbuffered printer with a print speed of 30 cps must be run at or below 300 baud, and an unbuffered 120 cps printer would have to be run at or below 1200 baud. If your printer cannot keep up with the 930A, switch to a lower baud rate or use one of the printer flow control handshakes described in **Section 6-89** of this manual. Hard copy terminals, such as Teletypes and DECwriters, may also be used as printers, but their low speed tends to degrade 930A performance.

While the 930A can be connected to most serial printers without modification or special cables, printers vary widely in terms of interface requirements. Some may require special cables or an adaptor. Refer to **Figure 7-2** for the pinouts of the 930A serial interface.

7-2.1 Printer Mode Parameters



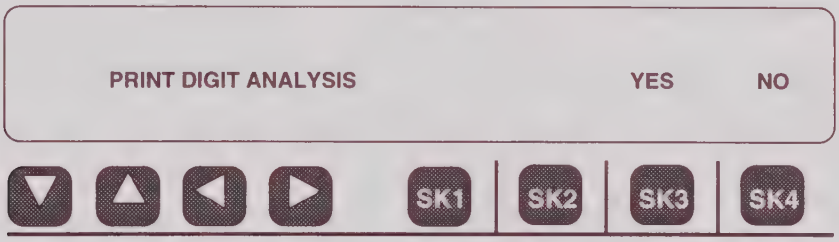
After completing the set-up procedure outlined in **Section 7-1**, scroll through the remote mode options by pressing softkey 2. When **PRINTER** is displayed, press softkey 4 under **EXIT** to see:



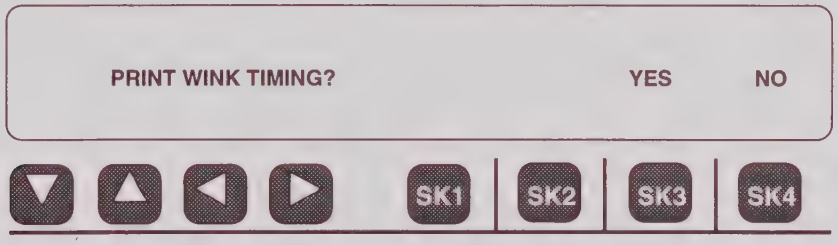
To print PCM errors, press softkey 3 under **YES**, otherwise press softkey 4.

In either case, the 930A display will advance to the following screen:

To print calls captured by the digit receiver, press softkey 3 under **YES**, otherwise press softkey 4. Selecting **YES** displays the following screen. Selecting **NO** skips the following screen.



To print the analysis of the received digits, press softkey 3 under **YES**, otherwise, press softkey 4. The 930A display advances to:



To print the wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A will exit this Option Menu. The printer will begin to print whenever one of the conditions occurs, or whenever the **ENT** key on the 930A is pressed.

Press the **ENT** key to test your connection. If the output is garbled, adjust the baud rate, parity, or number of bits. To suspend printing for any reason without taking the 930A out of the printer mode, turn off the printer.

> *Taking the printer off-line instead of turning off the power may not have the desired effect. The printer buffer may fill up with unwanted material which will be printed out when the printer is placed back on-line.*

7-2.2 Printer Handshake

OPTION MENU #: 89 PRINTER HANDSHAKE allows you to select a form of flow control when the 930A sends data to the printer. This allows the printer to tell the 930A to stop sending when the printer's buffer is full or the printer is off-line. The factory default setting for the 930A is handshake **OFF** because it is not usually necessary.

If your printer misses characters sent by the 930A, especially during long printouts such as digit analysis or T1 BERT history, select a lower baud rate or use **OPTION MENU #: 89 PRINTER HANDSHAKE** to select a form of flow control. Refer to **Section 6-89** for information on printer handshake set-up.

7-2.3 Printer Applications

ERRORS, RECEIVED DIGITS, DIGIT ANALYSIS and **WINK TIMING** may be printed as selected previously. The results of ROTL/Responder tests, frequency sweep and envelope delay measurements will be printed out automatically as they occur if the 930A is in **PRINTER** remote mode. The 930A will also automatically print out every 4 hours or whenever its buffer is full when it is in **OPTION MENU #: 8 SUPERVISION MONITOR**.

If **ERROR** reporting is selected, all detected PCM errors will be time stamped and printed out as they occur. If **RECEIVED DIGITS** reporting is selected, received calls will be printed out whenever a Digit Receiver sequence is completed, or whenever the originating end abandons the call (goes on-hook) in mid-sequence. The number of calls, frequency of inter-LATA vs. intra-LATA calls, the number of incomplete ANI sequences and abandoned calls can all be determined from the 930A's reports. All reports include a time and date stamp. If **DIGIT ANALYSIS** has also been selected, the frequency and amplitude of each MF or DTMF tone is displayed together with the Interdigit time, as well as any spurious tones. Dial Pulse digits are analyzed in terms of % Break, Pulses per second and Interdigit time.

WINK TIMING information will be printed out whenever a record sequence is complete, a call is abandoned, or a wink fails. The 930A times supervision events such as winks when it sends digits or when it receives digits in **MONITOR** mode. When the 930A acts as a terminating digit receiver, it provides the winks rather than timing them. **WINK TIMING** printouts can show the time between line seizure and the first wink, the length of all winks, the time between the end of a digit sequence and a wink, and the time between call completion and answer supervision.

7-2.4 Print Formats

This section provides report format details and examples of 930A printouts for the various types of information.

PCM ERROR REPORTS

Description: The label "PCM1:" followed by one blank and the error detected on PCM1 (if any). The label "PCM2:" followed by one blank and the error detected on PCM2 (if any). An error report is a 40 character string terminated by a line feed and carriage return. The error report will have the following form:

PCM1: NO PCM!	PCM2: NO PCM!
FRAME LOSS	FRAME LOSS
FRAME ERROR	FRAME ERROR
SLIP	SLIP
BIPOLAR VIO	BIPOLAR VIO
REMOTE ALARM	REMOTE ALARM
BLUE ALARM (ESF)	BLUE ALARM (ESF)
CRC ERROR (ESF)	CRC ERROR (ESF)
>15 ZEROS	>15 ZEROS

RECEIVED RECORD REPORTS

A report may consist of up to four received records. Each record is a string of 40 characters terminated by a line and feed carriage return. The final record is followed by an additional carriage return and line feed. Each record takes the form:

0123456789#*ABCD REC#N HOLD DTMF

Description: There is a 17 character record field, followed by the label "REC#", the record number (1-4), three blanks, the word "HOLD", three blanks, and the label "MF", "DTMF" or "DP". Dial Pulse records can be digits from 0 to 9. DTMF records can be all digits from 0 to 9 plus the characters "A", "B", "C", "D", "*", and "#". MF records may additionally include the characters "KP", "ST", "STP", "ST2P", and "ST3P". There are no spaces between characters, and records containing less than 17 characters are preceded by blanks.

WINK TIMING REPORTS

Wink timing reports will include all completed or interrupted supervision events from the last record sequence received. Each supervision event is sent as three strings. Each string is terminated by a line feed and carriage return. The first string takes the form: EVENT #N.

The string is six characters in length and all supervision events (winks, off-hooks, and delays) are preceded by this string. The second string takes the form:

```
W 01 W 02 03 W H      NNNN MSEC GUARD (any sequence)
>16,000               MSEC
>60,000               MSEC
```

The record sequence is printed first and may be up to 17 characters long (shorter sequences are preceded by blanks). The length of the Guard period in milliseconds, or a time-out indicator, followed by the word "GUARD" is printed out next. This string is 40 characters long. The third string takes the form:

```
W 01 W 02 03 W H      NNNN MSEC WINK (any sequence)
>200                  MSEC
OFF-HOOK              FAILED      DELAY
```

The record sequence is printed first, and may be up to 17 characters long (shorter sequences will be preceded by blanks). Next, the length of the event in milliseconds, or a time-out or failure indicator, followed by an event type label is printed out. This string is also 40 characters long. The final supervision event in the report is followed by an additional line feed and carriage return.

7-3 TERMINAL MODE

The 930A supports the Televideo family of terminals (the Televideo 910, 910+, 912, and 925), terminals which can be set to emulate Televideo (ADM, WYSE, and Hazeltine) and the VT-100 family of terminals.

The VT-100 terminals are semi-intelligent types. The 930A supports not only the VT-100 family, but also those terminals that emulate the VT-100. VT-100 is ANSI standard; any ANSI terminal may be used.

If you have a choice between Televideo and VT-100 emulation, choose Televideo. It is faster and will allow you to use your terminal cursor keys to control the 930A's Up/Down and Left/Right arrow keys.

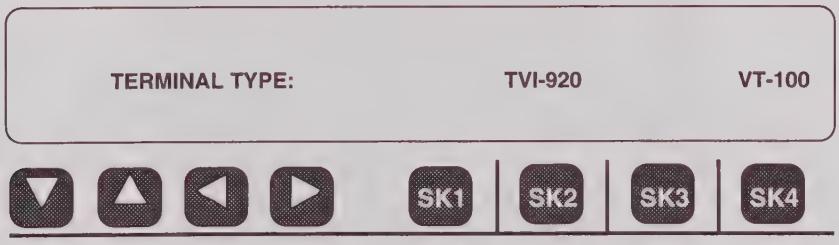
Terminal emulation programs such as CROSSTALK® and PROCOMM® allow a PC to operate the 930A in Terminal Mode. Sage Instruments' STARMAC® Macro language program also allows you to operate the 930A in Terminal mode. Contact Sage Instruments for more information on STARMAC.

The 930A currently does not support Teletypes or other "hard copy only" terminals such as DECwriters, except in PRINTER remote mode (refer to **Section 6-2** for details).

CROSSTALK® and PROCOMM® are registered trademarks.

7-3.1 Terminal Mode Parameters

After completing the set-up procedure outlined in **Section 7-1**, scroll through the remote mode options by pressing softkey 2. When **TERMINAL** is displayed, press softkey 4 under **EXIT** to see:



Press softkey 2 to use Televideo 920 (or similar terminal), or softkey 4 for a DEC VT-100 terminal. The 930A display will return to the previous display.

The Terminal's display will be somewhat like that shown in **Figure 7-3** below.

```
NORMAL LOOP    TERM    CONTACT  2W     900     o       t     (Current Trunk Type)
               [ J ]    [ K ]  [ L ] [; ]  ORIG    TERM

A)    TRUNK TYPE
B)    DIAL/RING
C)    RETURN LOSS
D)    SEND TONE
E)    MEAS TONE
F)    MEAS NOISE
G)    OPTIONS

UPPERCASE  O)    GO OFF HOOK?)  HELP    CR) ENTER   SP)   CLEAR
Lowercase  o)    GO ON HOOK  S)  STO      R) RCL      N)   RCL NEXT

When sending digits:
To send:   0  1  2  3  4  5  6  7  8  9  -  KP  ST  STP  ST2P  ST3P  +/-
   Type:   0  1  2  3  4  5  6  7  8  9  -   *   #   a    b     c     d
```

Figure 7-3
COMPUTER DISPLAY IN TERMINAL MODE

7-3.2 PC Keyboard Equivalents to the 930A

Each key on the 930A's front panel is mapped to a key on your PC's keyboard. Pressing a key on your PC has the effect of pressing the equivalent key on the 930A. All commands given to the 930A manually can also be done remotely. All legal commands are listed on the screen and all measurements are returned immediately and updated continuously.

The following describes the PC keyboard key presses as they relate to the 930A's function keys.

Figure 7-4
930A FRONT PANEL

The main function keys on the 930A (the black keys along the left edge of the front panel) are mapped to the uppercase letters **[A]** through **[G]**. The 930A uses almost exclusively uppercase commands. Enable CAPS LOCK on your PC.

[A] = Trunk Type
[B] = Dial/Ring
[C] = Return Loss
[D] = Send Tone
[E] = Measure Tone
[F] = Measure Noise
[G] = Option Menu

To send the lowercase [a], [b], [c] or [d] with CAPS LOCK on, press the SHIFT key along with the letter.

The Up/Down and Left/Right keys on the 930A are mapped to the cursor keys on your PC. Set NUM LOCK to off or your PC cursor keys will act as number keys. If you have the enhanced AT keyboard (101 keys), you have a second set of cursor keys that are unaffected by NUM LOCK. As an alternative to the standard keyboard, use **[Ctrl-J]** for down, **[Ctrl-K]** for up, **[Ctrl-H]** for left and **[Ctrl-L]** for right, without affecting NUM LOCK.

The four unlabeled softkeys below the 930A's display are mapped to the **[J]**, **[K]**, **[L]** and **[;]** keys on your PC. The softkeys select or change the fields shown above them on the 930A's display.

The numeric keypad digits 0-9 map to the digits 0-9 on your PC's keyboard. You may use a separate keypad, use the integrated keypad and NUM LOCK, or use the digits 0-9 along the top of any PC's keyboard. (If you use NUM LOCK and the integrated keypad, you will lose the use of your cursor keys while NUM LOCK is on.) The **KP/*** key is mapped to your PC's asterisk **[*]** key. The **ST/#** key is mapped to your PC's pound **[#]** key. The **A/STP** key is mapped to lowercase **[a]**. Similarly, the **B/ST2P**, **C/ST3P** and **D/+/-** keys are mapped to lowercase **[b]**, **[c]** and **[d]**.

The special function keys (the light gray keys in the center of the 930A front panel) are mapped as follows: **[S]** is for Store (**STO**), **[R]** is for Recall (**RCL**), **[N]** is for Recall Next (**RCL NXT**), the **[SPACE BAR]** is for Clear (**CLR**), the **[ENTER]** key is for Enter (**ENT**) and the Question Mark **[?]** is for Help (**HELP**).

The hookswitch is mapped to the **[O]** key. Uppercase **[O]** is **Off Hook**. Lowercase **[o]** is **On Hook**.

When monitoring the 930A's supervision lamps, a lowercase **[o]** and **[t]** in the display indicate that both the originating and terminating ends are **On Hook**. An uppercase **[O]** and **[T]** indicates an **Off Hook** condition at the originating or terminating end. A **[-]** in either location means no indication and generally signifies an incomplete or faulty circuit.

7-3.3 Troubleshooting

SYMPTOM: Terminal CRT remains blank.
PROBABLE CAUSE: Faulty or improper RS-232 cable connection.
APPROACH: Check cables, power to the terminal and RS-232 pinouts.

SYMPTOM: Terminal prints “gibberish”.
PROBABLE CAUSE: Incorrect data format.
APPROACH: Turn terminal off. Set 930A Remote Mode to **OFF**. Check 930A baud rate, parity, character size, and stop bits. Check terminal DIP switches to be sure of their data format. Turn terminal on. Set the 930A remote mode to **TERMINAL** and press softkey 4 to **EXIT**. Select a terminal type.

SYMPTOM: The 930A does not respond to terminal commands.
PROBABLE CAUSE: Bad mechanical connection or CAPS LOCK not down.
APPROACH: For mechanical condition, check the cables and connectors (broken pins), power, and RS-232 pinouts. Be sure that uppercase commands are being sent when intended. The 930A uses only a few lowercase commands so the CAPS LOCK key on the terminal should generally be down.

SYMPTOM: 930A responds to some commands but not others.
PROBABLE CAUSE: Broken lead in RS-232 cable or wrong data format.
APPROACH: For data format, refer back to the "gibberish" symptom. Be sure parity and number of bits are correct. Test the RS-232 cable with an ohmmeter or by replacing with another cable.

7-4 COMPUTER MODE

The 930A can be operated under the control of any computer capable of sending and receiving serial ASCII characters over an RS-232 link. Each character sent to the 930A is treated as a key-stroke from the 930A's front panel. Sending the ASCII character is the equivalent of pressing the 930A key associated with it. For example, sending the uppercase ASCII character "A" is the same as pressing the Trunk Type function key. Refer to **Table 7-1** for ASCII-to-Front Panel conversions as well as HEX and Decimal equivalents.

It is strongly recommended that the Terminal mode be used when writing or debugging programs intended for use in the Computer mode. Terminal mode is fully interactive and comes with on-screen HELP.

Terminal emulation programs such as CROSSTALK® and PROCOMM® allow a PC to operate the 930A in Computer Mode. Sage Instruments' STARMAC® macro language program also allows you to operate the 930A in Computer mode. Contact Sage Instruments for more information on STARMAC.

There are a few ASCII characters (H, s, m, W, X, Y and Z) that will cause the 930A to perform special functions that are only performed remotely. These characters do not correspond to any keys on the 930A front panel. Refer to **Table 7-2** for details.

ASCII CHARACTER	930A FUNCTION	HEX	DECIMAL
[A]	Trunk Type	41	65
[B]	Dial/Ring	42	66
[C]	Return Loss	43	67
[D]	Send Tone	44	68
[E]	Measure Tone	45	69
[F]	Measure Noise	46	70
[G]	Option Menu	47	71
[ENTER]	Enter (ENT)	0D	13
[SPACE]	Clear (CLR)	20	32
[?]	Help (HELP)	3F	63
[S]	Store (STO)	53	83
[R]	Recall (RCL)	52	82
[N]	Recall Next (RCL NXT))	4E	78
[d]	Change Sign (+/-)	64	100
[–]	Pause (Left Arrow)	2D	45
[O]	Go Off Hook	4F	79
[o]	Go On Hook	6F	111
[J]	Softkey 1	4A	74
[K]	Softkey 2	4B	75
[L]	Softkey 3	4C	76
[;]	Softkey 4	3B	59
[^H] (¨ Cursor)	Left Arrow	08	8
[^L] (Æ Cursor)	Right Arrow	0C	12
[^K] (≠ Cursor)	Up Arrow	0B	11
[^J] (Ø Cursor)	Down Arrow	0A	10

TO SEND	TYPE	HEX	DEC	TO SEND	TYPE	HEX	DEC
0	0	30	48	*	*	2A	42
1	1	31	49	#	#	23	35
2	2	32	50	A	a	61	97
3	3	33	51	B	b	62	98
4	4	34	52	C	c	63	99
5	5	35	53	D	d	64	100
6	6	36	54	KP	*	2A	42
7	7	37	55	ST	#	23	35
8	8	38	56	STP	a	61	97
9	9	39	57	ST2P	b	62	98
				ST3P	c	63	99

Table 7-1
ASCII TO FRONT PANEL KEY CONVERSION

ASCII CHARACTER	930A FUNCTION	HEX	DECIMAL
[H]	Causes the 930A to send a copy of its terminal HELP screen (see **Figure 7-3**) to the remote computer or terminal.	48	72
[m]	Causes 930A to send Hang-Up string to a Hayes compatible MODEM.	6D	109
[s]	Places 930A in **STANDBY MODE**.	73	115
[W]	Causes the 930A to report all pending PCM errors, received records, wink timing information or 105 test results to the host computer. Information is "pending" when an ALERT has been sent but no REPORT has been requested.	57	87
[X]	Interrupts the 930A and causes it to send an immediate copy of its current display line to the host computer. This command is not buffered and executed in turn. It is executed at once.	58	88
[Y]	Causes the 930A to send a copy of its current display line to the host computer. This command is buffered and executes after all previous commands have been completed.	59	89
[Z]	Causes the 930A to send a copy of its current display line after it determines that a valid measurement has been made. A series of consecutive [Z] commands will cause the 930A to send consecutive measurements to the host computer.	5A	90

NOTES: The [X], [Y], and [Z] commands all cause the 930A to send a copy of its display line to the host computer.

The [X] command executes immediately and can be used to find the current status of the 930A. This allows "spot checking" progress through a command sequence at any time.

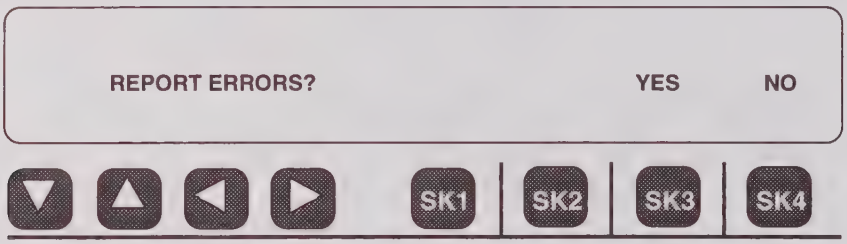
The [Y] command tells the 930A to send a copy of its display line when it reaches a certain point in the command sequence. This can be used to obtain a measurement or start a timer in the host.

The [Z] command is like the [Y] command, except that successive [X] commands will each be delayed by one measurement period.

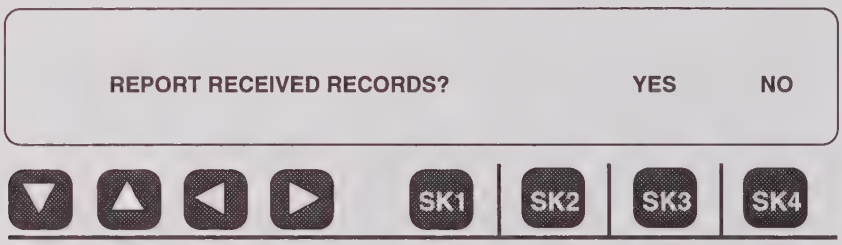
Table 7-2
SPECIAL ASCII CHARACTERS FOR REMOTE CONTROL

7-4.1 Computer Mode Parameters

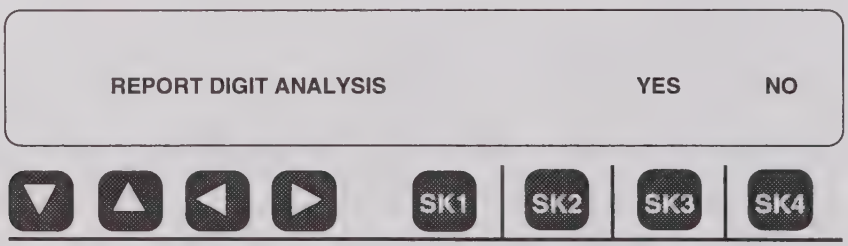
After completing the set-up procedure outlined in **Section 7-1**, proceed to **`OPTION MENU #: 34 SELECT REPORTS`**. Press the **Option Menu** function key until the display reads **`OPTION MENU #:`**. Press the Up/Down arrow keys to scroll through the option menus, or select **`34`** via the numeric keypad. In either case, press **ENT** or any softkey to activate your selection. If in **`PRINTER`** remote mode, the display will read **`PRINT ERRORS?`** Otherwise, the following screen will display:



To send the PCM formatted error report, press softkey 3 under **`YES`**, otherwise press softkey 4. In either case, the 930A display will advance to the following screen:

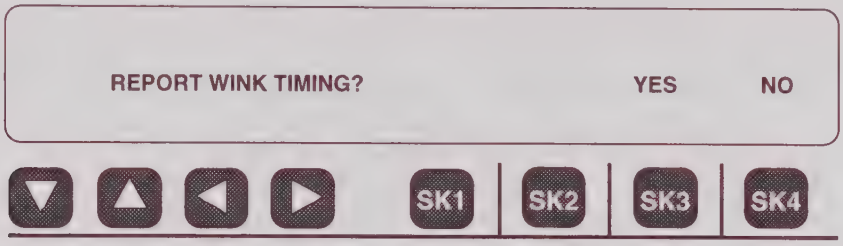


To send the report on calls captured by the digit receiver, press softkey 3 under **`YES`**, otherwise press softkey 4. Selecting **`YES`** displays the following screen. Selecting **`NO`** skips the following screen:



To send the report on the analysis of the received digits, press softkey 3 under **`YES`**, otherwise, press softkey 4.

The 930A display advances to:



To send the report on wink timing measurements, press softkey 3, otherwise press softkey 4. The 930A display should then read:

A prompt will be sent to the host computer to indicate that the 930A's command buffer is empty and the 930A is awaiting instructions.

7-4.2 Input to the 930A

Input to the 930A is in the form of "command strings." These are strings of ASCII characters that the 930A recognizes as commands. A command string may be from 1 to 40 characters in length. The 930A has a 40-character input buffer. **Tables 7-1** and **7-2** contain summaries of these commands and **Section 7-3.2** describes them.

The 930A will echo each character back to the computer as it is received and placed in the buffer. **DO NOT SEND THE NEXT CHARACTER UNTIL THE ECHO HAS BEEN RECEIVED**. This is the 930A input protocol (actually a handshake). The 930A executes the commands in the order they are received, with the exception of the `[X]` command which executes immediately. When all received commands have been executed and the input buffer is empty, the 930A will signal the host computer with a ">" prompt.

The 930A will echo and ignore any characters it does not recognize as commands.

7-4.3 Output from the 930A

Output from the 930A consists of the following:

ECHOES The 930A echoes all received characters to the host computer.

PROMPTS When the 930A has executed all received commands and its command buffer is empty, it sends a prompt consisting of a line feed, carriage return, and a `[>]` character. The ASCII sequence in Hexadecimal code is 0A 0D 3E. Some data strings include the `[>]` character, but the 0D 3E sequence is unique.

ALERTS Under certain circumstances, the 930A will send a "bell" character (ASCII 07) to alert the host computer that it has something to report. Any programs the user writes should screen all 930A output carefully for this character. If the **`OPTION MENU #: 15 BEEP ON ERROR`** is set to **`OFF`**, the bell character will not be sent.

DATA When the 930A executes an `[X]`, `[Y]`, or `[Z]` command, it sends a copy of its current display line and supervision status. This is a 50-character line terminated by a line feed and carriage return. **Section 7-4.4** contains details of display line formats.

REPORTS If the 930A has sent the host computer an ALERT, it will respond to the `[W]` command with a report concerning what caused the ALERT. This could be a PCM error, a completed Receive Record sequence, Wink Timing information, 105 test results, or some combination of the four. **Section 7-4.4** contains further details of Report Formats. When used as a near-end responder (**`OPTION MENU #: 26 ROTL RESPONDER`**), the 930A will send an alert (bell) at the completion of each test.

7-4.4 Display Line Formats

A Display Line is always 50 characters long, terminated by a carriage return and line feed. The first 40 characters of a Display Line mirror the display on the front panel of the 930A. The next 4 characters are ASCII blanks. The next character shows originating supervision. The next 4 characters are ASCII blanks. The last character shows terminating end supervision.

In the following examples of typical PC screen displays, numbers are denoted by a single **[N]** for each possible digit. Each **[N]** may stand for any number. Signed numbers are shown preceded by a **[+]** or **[-]** character.

Leading zeros are printed as blanks and trailing zeros are printed as zeros. The digit to the left of the decimal point will always be printed, including leading zeros. The sign of the number will always be printed to the left of the first non-blank digit. Uppercase **[O]** or **[T]** indicates an off-hook condition; lowercase **[o]** or **[t]** represent an on-hook condition. These symbols are not seen on the 930A display.

Typical example displays of the computer's CRT are below:

In Measure Tone:

NNNN Hz	**+NN.N**	**dBm0**	**AVERAGE**	**PCM1**	**O**	**T**
----	**OVER**	**dBm**	**RMS**	**PCM2**	**o**	**t**
----		**dB**		**T1R1**	**-**	**-**
----		**dB**		**TR**	**-**	**-**

Description -- Seven leading blanks, followed by the frequency in Hz or four dashes, the label **Hz**, a signed level or the over or under indication (**OVER** or ----), the relative zero label, the **AVERAGE** or **RMS** label, and the signal source label.

In Measure Noise:

+NNN	**dBrn0**	**C-NOTCH**	**PCM1**	**CHANNEL**	**O**	**T**
	dBrn	**3K FLT**	**PCM2**	**N-TO-G**	**o**	**t**
	dB	**C-MSG**	**T1R1**	**BAL**	**-**	**-**
	dB	**S/N**	**TR**			

Description --- Three leading blanks, followed by a signed level measurement, the relative zero label, the filter type, the signal source label, and the type of measurement.

In 4W Return Loss:

+NNNdB	SRL LO	NNNN Hz	+NN THL	4W 1200	O	T
	SRL HI			4W 900	o	t
	ERL			4W 600	-	-
	OSC			PCM1		
				PCM2		

Description --- Two leading blanks, followed by a signed level measurement and the label **dB**, the signal type, the frequency of the echo suppress tone or the oscillator tone, and the label **Hz**, a signed transhybrid loss level and the label **THL**, and a Trunk Type label.

In 2W, Normal Return Loss:

+NNNdB	SRL LO	NNNNHz	2W 1200	O	T
	SRL HI		2W 900	o	t
	ERL		2W 600	-	-
	OSC		2W 150		

Description --- Two leading blanks, followed by a signed level measurement and the label **dB**, the signal type, the frequency of the echo suppress tone or oscillator tone, and the label **Hz**, 10 blanks, and a Trunk Type label.

7-5 PROGRAMMERS NOTES

7-5.1 Initializing the 930A

Send the command string **[AAA]** when you first access the 930A remotely. This ensures that you have exited from any tests or submenus the 930A may have been left in. You may use any of the function key commands (**[A], [B], [C], [D], [E], [F]** or **[G]**), but three repetitions is the minimum necessary to bring the 930A to a known state before testing. By sending **[AAA]** you take the 930A to the Trunk Type menu, no matter where it was previously. Sending **[GGG]** would take the 930A to the Option Menu instead.

After this initial string has been sent, send a Trunk Type initialization string to ensure that the 930A is properly terminated or bridged, looking at the correct signaling leads, etc. Use the **HELP** menu in Trunk Type to accomplish this (see the following pages for details). Two examples would be:

```
NORMAL          LOOP      TERM   CONTACT  2W 900:     [A?J;;LKK]
E&M  TYPE II    TERM      SEND-E           4W 600:     [A?L2JK;K;]
```

Append a lowercase **[o]** to your initialization string to ensure that the 930A is on hook.

To ensure that the 930A is in quiet termination (sending no tone), send a Send Tone initialization string such as **[?;1004J160J]**. This sequence sets the frequency to 1004 Hz, the level to -16.0 dBm, and the output to **OFF**. The numeric input for frequency and level were terminated by the **[J]** character. Numeric input may be terminated by a carriage return or any softkey (**[J], [K], [L], [;]**). The **[J]** character has been used in all the examples contained in this document.

You may now use the 930A to send or receive calls, send and measure tones and other VF signals, and perform automated tests to remote testlines and responders. The following section on **HELP** menus will get you started. There are separate sections on placing multistage calls using the digit receiver/analyzer, and placing calls to remote testlines and responders.

For the convenience of programmers, the 930A may be commanded remotely to dump its buffers and restore itself to the factory defaults. **OPTION MENU #: 92 SOFTWARE COLD-BOOT** is used for this purpose.

To remotely cold-boot the 930A, perform the following sequence: **GGG92|K**

This command does not affect the RS-232 remote port settings nor does it affect the time/date settings.

> *A hardware cold-boot (recycling power while holding down a function key) will restore the RS-232 port settings to their factory default values.*

7-6 HELP MENU IN REMOTE CONTROL

Pressing the **HELP** key on the 930A brings up a series of menus for the user. The menu presented will depend on the function the 930A is executing. Transmitting the ASCII `[?]` character remotely has the same effect as pressing the **HELP** key on the 930A front panel.

Many of the 930A's features are controlled using softkeys (the four unlabeled keys directly beneath the display). The current setting is usually displayed above the softkey. If the 930A displayed your parameter, continue to the next display, otherwise press the softkey until the 930A displayed the setting you wanted.

Using the **HELP** menus allows the computer to avoid this procedure. Once you have used a **HELP** menu to put the 930A in a known state, it may be more efficient to use the softkeys in the usual way. You would always use the **HELP** menus when your program begins: this provides a simple and foolproof initialization. After using a **HELP** menu once to put the 930A in a known state, you may continue to use the **HELP** menus throughout your program.

The following section gives a brief overview of the **HELP** menus and includes some sample command strings.

Trunk Type function key (Analog circuits)

Trunk Type	Help	Type/Sense	Direction	Bridge/Term	Ohms	2W/4W

Trunk Type	**[A] =**	**Trunk Type**				
Help	**[?] =**	**Help**				
Type	**[J] =**	**Loop**	**[K] = Ground-Start**	**[L]= {1-5}**	**[J] = E&M Type I-5**	
Sense*	**[K] =**	**Normal**	**[;] = Reverse**			
Direction	**[K] =**	**Battery**	**[;] = Contact**	**[K] =SEND-E**	**[;] = SEND-M**	
Bridge/Term	**[K] =**	**Bridge**	**[;] = Terminate**			
Ohms	**[J] =**	**150Ω**	**[K] = 600Ω**	**[L] = 900Ω**	**[;] = 1200Ω**	
2W/4W	**[K] =**	**2 Wire**	**[;] = 4 Wire**			

* (Loop and Gnd-Start only)

Examples:

```
E&M Type I        TERM        SEND-E      4W 600      [A?L1JK;K;]
E&M Type II       TERM        SEND-M      2W 900      [A?L2J;;LK]
LOOP NORMAL       TERM        CONTACT     2W 900      [A?JK;;LK]

Toggle Bridge/Term        [K]
Toggle Direction                  [L]
```

Dial/Ring function key

Dial/Ring Help Pulsing Digits

Dial/Ring B = Dial/Ring
Help ? = Help
Pulsing K = Dial Pulse L = MF ; = DTMF

Digits Up to 17 digits
All pulsing types: 0-9, [–] for 1 sec. pause
DTMF: a,b,c,d,*,#
MF: *=KP, #=ST, a=STP, b=ST2P, c=ST3P

If you are already off-hook, the digits will be sent immediately. If you are on-hook, the digits will be stored in **Dial/Ring**. Go off-hook and send ASCII `[K]` to send stored digits.

Sending an ASCII blank (spacebar) `[ ]` clears any existing digits. Using the **HELP** key also clears any previous digits.

Examples:

Go to **Dial/Ring**. Go off-hook. Select DTMF. Dial (408) 761-1000:
`[BO?;4087611000]`

Go to **Dial/Ring**. Go on-hook. Select MF. Store KP007ST to be dialed later:
`[Bo?L*007#]`

Go to **Dial/Ring**. Go off-hook. Select Dial Pulse. Pause 1 second and dial 9:
`[BO?K-9]`

Go to **Dial/Ring**. Go off-hook and send the most recently entered digit string:
`[BOK]`

Go to **Dial/Ring**, clear any old digits, and dial 411 in the current pulse mode:
`[B 411]`

Return Loss function key

4W:

Return Loss Help Band Frequency Acknowledge Set THL

Return Loss **[C] = Return Loss**
Help **[?] = Help**
Band **[J] = SRL-LO** **[K] = SRL-HI** **[L] = ERL** **[;] = OSC (sine wave)**
Frequency **[nnnnJ]** = freq. of nnnn Hz for echo suppress tone and/or sinewave return loss
Acknowledge **[J],[K],[L] or [;]** =acknowledges message
Set THL **[L]** = Current measurement is THL **[;nnJ]** = THL is -nn dB

2W:

Return Loss Help Mode [Band Frequency] or [Termination]

Return Loss **[C] = Return Loss**
Help **[?] = Help**
Mode **[K] = Return Loss** **[;] = TR Termination**

Return Loss:

Band **[J] = SRL-LO** **[K] = SRL-HI** **[L] = ERL** **[;] = OSC (sine wave)**
Frequency **[nnnnJ]** = freq. of nnnn Hz for echo suppress tone and/or sinewave

TR Termination:

Termination: **[J] = AC Short** **[K] = 600Ω+2.14μF** **[L] = 900Ω+2.14μF** **[;] = AC Open**

Examples:

4W:

Go to Return Loss. Select ERL, 2225 Hz Echo Suppress, no THL compensation: `[C?L2225JJ0J]`

Go to Return Loss. Select SRL-LO, 2225 Hz Echo Suppress, measure THL: `[C?J2225JJK]`

2W:

Go to Return Loss. Select SRL-LO, 2225 Hz Echo Suppress tone: `[C?KJ2225J]`

Go to Return Loss. Select 900Ω with 2.14μF quiet termination: `[C?;L]`

All types:

Send echo suppress tone: `[K]`

Send Tone function key

Send Tone Help Output Frequency Level

Send Tone	**[D =]**	**Send Tone**
Help	**[? =]**	**Help**
Output	**[K =]**	**ON [;] = OFF**
Frequency	**[nnnnJ]** = frequency of nnnn Hz	
Level	**[nnnJ]** = level of -nn.n dBm (for level of +nn.n dBm, send **[nnndJ]**)	

Examples:

Send 1004 Hz at 0.0 dBm: **[D?K1004J0J]**

Send 1004 Hz at -16.0 dBm: **[D?K1004J160J]**

Send 2804 Hz at -13.0 dBm: **[D?K2804J130J]**

Send 404 Hz at +3.2 dBm: **[D?K0404J32dJ]**

Set frequency and level to 1004 Hz at -10.0 dBm, do not send tone: **[D?;0104J100J]**

Toggle tone on/off: **[D;]**

Set frequency to 1010 Hz: **[DJ1010J]**

Set level to -16.0 dBm: **[DK160J]**

Measure Tone function key

Measure Tone Help Reference Mode*

Measure Tone **[E] = Measure Tone**
Help **[?] = Help**
Reference **[K] = Absolute (dBm)** **[L] = Set 0** (dB relative to current level)
[;nnnJ] = dBm0 (dB relative to -nn.n dBm)
Mode* **[K] = Average**[1] **[;] = RMS**[2]

* Software Rev. 3.17 and later.
1 Use **AVERAGE** to measure sinewaves.
2 Use **RMS** to measure the level of non-sinewave tones and digital milliwatt.

Examples:

Measure in dBm: **[E?KK]**

Make future measurements in dB relative to -16.0 dBm: **[E?;160JK]**

Make future measurements in dB relative to current measured level: **[E?LK]**

Make **RMS** measurements in dBm: **[E?K;]**

Toggle **RMS/AVERAGE**: **[L]**

Measure tone: **[E]** **[Z]** (Wait 1 sec. between sending **[E]** and **[Z]** or **[EZZ]**. Disregard first measurement.

> *If a tone has been selected in **Send Tone** and the output is **ON**, the tone will also be sent in **Measure Tone**. To measure far-to-near tone on a 2-wire circuit, be sure **Send Tone's** output is set to **OFF**.*

Measure Noise function key

Measure Noise Help Filter Mode* Reference

Measure Noise	**[F] = Measure Noise**		
Help	**[?] = Help**		
Filter	**[J] = 3 KHz flat**	**[K] = C-Message**	**[L] = C-Notch [;] = Signal/Noise**
Mode* †	**[K] = Balanced**	**[;] = Noise/Ground**	
Reference †	**[K] = Absolute** (dBrn)	**[L] = Set 0** (dB relative to current level)	
	[;nnndJ] = dBrn0 (dB relative to nnn dBrn)		

* Not available in PCM. In PCM the 930A measures channel noise only.
† Not available when making signal/noise measurement.

Examples:

Measure balanced noise in dBrnC using the C-Notch filter: **`[F?LKK]`**

Measure signal/noise: **`[F?;]`**

Measure noise-to-ground relative to 90 dBrn using the 3 KHz flat filter: **`[F?J;090dJ]`**

Measure noise: **`[F]`** **`[Z]`** Wait 1 sec. between sending **`[F]`** and **`[Z]`** or **`[FZZ]`**.
Disregard first measurement

> *If a tone has been selected in **Send Tone** and the output is **ON**, the tone will also be sent in **Measure Noise**. To measure far-to-near noise on a 2-wire circuit, be sure **Send Tone's** output is set to **OFF**.*

7-6 BELL CHARACTER

The 930A can be set to wait for or detect a variety of events. The 930A sends the bell character to report these events. Some events are reported only if the user selects them; other events are reported only if the 930A is performing a certain function. Select the events to be reported from **`Option Menu #34: SELECT REPORTS`**. The following lists the events and conditions for a bell to be sent.

EVENT	REPORTED WHEN 930A IN:
PCM ERROR--An error on the T1 span such as a slip, bipolar violation, remote alarm, etc., has been detected.	PCM Trunk Type. REPORT PCM ERRORS selected.
INCOMING CALL COMPLETE--The 930A has received a call.	Option Menu 4: Digit Receiver REPORT RECEIVED RECORDS selected.
WINK TIMING AVAILABLE--A call has completed or abandoned, and a wink, off-hook, delay dial event, dial tone or credit card "bong" was expected.	Option Menu 2: Send Digit Sequences. Option Menu 4: Digit Receiver. REPORT WINK TIMING selected.
WINK FAILURE--An expected wink, off-hook, delay dial event, dial tone or "bong" failed to appear or was not recognizable.	Option Menu 2: Send Digit Sequences. Option Menu 4: Digit Receiver.
SIGNALING BIT CHANGE--An A, B, C, or D bit has changed state on one of the 24 PCM Channels.	PCM Trunk Type. Option Menu 20: 24 Bit Display.
RINGING or LINE SEIZURE--The 930A detects ringing or seizure and goes off-hook.	Option Menu 32: Dial-Up Testline. Option Menu 33: Dial-Up Sweep.
IMPULSE or HIT--An impulse, gain hit, phase hit or dropout has occurred.	Option Menu 11: Impulse and Hits.
CALL PROGRESS FAILURE--The 930A detects Busy, Reorder, Dead Line or any other call progress failure when it attempts to access a testline.	Calling to a testline from: Option Menu 2: Send Digit Sequences. Option Menu 26: ROTL/Responder. Option Menu 27: ROTL Interrogator. Option Menu 28: Transponder Test. Option Menu 29: Call 102 Line.
TEST DATA AVAILABLE--A test to a far-end testline has completed, or has a screen full of results available. LOSS has one screen of data (one bell), GAIN SLOPE has three screens of data (one bell each), etc.	Calling to a testline from: Option Menu 2: Send Digit Sequences. Option Menu 26: ROTL/Responder. Option Menu 27: ROTL Interrogator. Option Menu 28: Transponder Test. Option Menu 29: Call 102 Line.

8 SPECIFICATIONS

8-0 INTRODUCTION

This section contains general information regarding the installation and operation of the Sage Instruments 930A Communications Test Set.

The 930A specifications are listed in **Section 8-1**. These specifications are the performance standards or limits against which the instrument is tested. Options for the instrument have separate specifications which are provided on supplementary specification sheets or within the sections of this manual describing the specific option.

8-1 DESCRIPTION

The 930A combines the functions of a Transmission Impairment Measurement Set (TIMS); a Return Loss Measurement Set; Dial Pulse, Touchtone® (DTMF) and Multi-Frequency (MF) Sender and Talk Battery supply into one lightweight package. Hardware and software options allow the user to greatly increase the capabilities of the 930A.

8-1.1 Level/Frequency

Transmitter

Frequency Range:	20 Hz to 5000 Hz
Resolution:	1 Hz
Accuracy:	±1.0 Hz
Output Steps:	1 Hz, 10 Hz, 100 Hz, or 1000 Hz steps
Frequency Sweep:	Single or Continuous with selectable bounds, level and step size.
Level Range:	-60 dBm to +12 dBm
Resolution:	0.1 dB
Accuracy:	±0.1 dB @ 1004 Hz (0 to -19 dBm),
Flatness:	±0.2 dB (200 Hz to 5 kHz referenced to level at 1 kHz)
Distortion:	-70 dB @ 1004 Hz, 0 dBm

Receiver

Frequency Range:	20 Hz to 5000 Hz
Resolution:	1 Hz
Accuracy:	±1.0 Hz
Level Range:	-50 dBm to +12 dBm
Resolution:	0.1 dB
Accuracy:	±0.1 dB @ 1004 Hz (0 to -19 dBm), ±0.2 dB @ 200 Hz to 5 kHz

Noise

Input:	Balanced or Noise-to-Ground
Weighting Filters:	C-MSG, C-NOTCH, 3 kHz Flat
Notch Filter:	1010 Hz (995 Hz to 1025 Hz Notch); >60 dB Notch depth
Range:	10 dBrn to 100 dBrn (Balanced) 50 dBrn to 130 dBrn (Noise-to-Ground)
Resolution:	1.0 dB
Accuracy:	±0.5 dB

Signal-to-Noise

Level Range:	-50 dBm to +10 dBm
Noise Range:	10 dBrn to 90 dBrn
S/N Range:	10 dB to 70 dB
Accuracy:	±0.5 dB
Resolution:	1.0 dB

Return Loss

Modes:	ERL, SRL-Low, SRL-High or Sinewave (OSCillator mode)
Transmitted Signal:	Meets the specifications of Bell Publication 41009 (page 13, Tables D, E and F,) and IEEE Standard 743-1984

Echo Canceller Disable Tone

Frequency:	2100 Hz, ±1 Hz
Phase Reversals:	450 ms, ±5 ms; 180°, ±5°
Level:	–12 dBm0, ±1 dB

2-Wire Return Loss

Transmitter Level:	-10 dBm0
Receiver Range:	0 dB to 40 dB
Resolution:	1.0 dB
Accuracy:	±0.5 dB

Internal Hybrid Impedance: 600 or 900 Ohms ± 0.1% in series with 2.16 uF ± 1%

4-Wire Return Loss

Impedance:	150, 600, 900, or 1200 Ohms
Transhybrid Loss Compensation:	-30 dB to +30 dB
Transmitter Level:	-10 dBm0—in OSCillator mode the level is 0 dBm relative to the TLP
Receiver Range:	-10 dB to 50 dB
Resolution:	1.0 dB
Accuracy:	±0.5 dB

8-1.2 Supervision/Signaling

Wink Timing

Resolution:	5 msecs.
Accuracy:	±5 msecs.
Wink Fail Event:	Fails for wink period >600 msecs.
Off-Hook Fail Event:	Fails for Off-Hook period <600 msecs.

E/M Supervision

Types:	I, II, III, IV, V
Battery:	-48 VDC current limited to 200 mA

Threshold Voltages:

	E Lead	M Lead
On-hook	< -16 V	> -16 V
Off-hook	> -16 V	< -16 V

Loop Supervision

Types:	2- and 4-wire Loop Start, Ground Start, Loop Reverse Battery, and SX supervision.
Battery:	-48 VDC series limited to 120 mA

MF and DTMF Supervision

Frequency Accuracy:	±0.1% of Bell Standard Frequencies
Adjustment Range:	Tone Frequencies adjustable in 0.1% steps to ±10% of standard Bell frequencies for Margin Testin.
Level:	Automatically adjusted to -7 dBm0
Level Adjustment Range:	Tone level adjustable in 0.1 dB steps from -60.0 dBm to +6.0 dBm
Resolution:	0.1 dB
Accuracy:	± 0.2 dB
Timing:	MF: 70 ms Tone On and Tone Off (KP is 100 mS Tone On) DTMF: 50 ms Tone On and Tone Off
Timing Adjustment Range:	Tone On and Tone Off times adjustable in 1 ms steps from 13 msecs. to 267 msecs.
Resolution:	1 msecs.
Accuracy:	±1.0 msecs.

8-1.3 Dial Pulse Sender

PPS

Range:	2 to 50 PPS
Resolution:	0.1 PPS
Accuracy:	±1.0% at 10 PPS

% Break

Range:	5 to 95%
Resolution:	0.1%
Accuracy:	±1.0% for 25% to 75% BRK @ 10 PPS

Interdigit Timing

Range:	40 to 990 msecs.
Resolution:	10 msecs.
Accuracy:	±5 msecs.

8-1.4 General

Impedances:	150, 600, 900, 1200 Ohms and > 50 KOhms Bridging
Maximum DC Blocking:	160 VDC
Audio Bandwidth:	±3.0 dB 300 Hz to 3.0 kHz
Audio Volume:	Adjustable by front panel control
Longitudinal Balance:	90 dB at 60 Hz
Receiver Return Loss:	>30 dB 200 Hz to 5 kHz (600, 900, 1200 Ohms)
	>30 dB 800 Hz to 5 kHz (150 Ohms)
Display:	40 character vacuum fluorescent plus 4 LED's for on/off-hook status
AC Power Supply:	115 VAC ± 10%, 60 Hz
Operating Temperature:	0o C to 50o C
Storage Temperature:	- 40o C to 70o C
Dimensions:	5.79" H. x 14.33" W. x 14.25" D
Weight:	16 to 18 lbs. depending upon options

8-1.5 Purchased Options

MF/DTMF/DP Receiver and Analyzer (Option 930A-01)

MF and DTMF

Input Level Range:	-25 dBm to 0 dBm
Accuracy:	±0.2 dB
Resolution:	0.1 dB
Input Frequency Range:	±10% of AT&T standard frequencies for MF and DTMF tones
Accuracy:	±0.1%
Resolution:	1 Hz
Input Tone on/off Range:	35 msecs. to 250 msecs. Tone on 35 msecs. to 250 msecs. Tone off
Accuracy:	±5 msecs.
Resolution:	1 msecs.

Dial Pulse (DP)

PPS Range:	5 PPS to 30 PPS
Accuracy:	±2% @ 10 PPS
Resolution:	0.1 PPS
% Break:	10% to 90%
Accuracy:	±2% (25% to 75% break at 10 PPS)
Resolution:	1%
Interdigit Timing Range:	50 msecs. to 990 msecs.
Accuracy:	±5 msecs.
Resolution:	1 msec.

SF Supervision (Option 930A-02)

SF Oscillator:	2604 Hz ± 1.0 Hz
Send Level:	-36 dBm0 on-hook, -13 dBm0 pulse
Receiver Sensitivity:	-42 dBm0

Peak-to-Average Ratio (P/AR) (Option 930A-06)

Transmit Level Range:	0 dBm to -40 dBm
Resolution:	0.1 dB
Receive Level Range:	-40 dBm to +12 dBm
Resolution:	0.1 dB
P/AR Measurement Range:	0 to 120 P/AR units
Resolution:	1 P/AR unit
Accuracy:	±1 P/AR unit

3-Level Impulse Noise (Option 930A-07)

Weighting Filter:	C-Notch
Threshold Range:	30 dBrnC to 106 dBrnC
Accuracy:	±1.0 dB
Threshold Spread:	2, 4, 6, or 8 dB steps
Timer:	1 min. to 99 mins. or continuous
Counter Capacity:	0 to 9999 for LO, MD and HI.
Measurements Range:	7 to 99 measurements per second

DS-1 PCM Drop/Insert Options (Options 930A-08E, 09E)

Format:	DS-1 AMI or B8ZS Line Code
DS-1Input Frequency:	1.544 Mbps ±15 kbps
Jitter Tolerance:	Exceeds Bell Pub 43802 Requirements
Channel Numbering Sequence:	D1D, D2, D3/D4/D5
Signaling Mode:	NORM (Robbed Bit) or CCIS
Framing Format:	D4 Superframe, Extended Superframe or SLC-96
Selection:	Automatic or manual selection of frame format-D4/SF or ESF
Input Mode:	Terminated: 100 Ohms nominal Bridging: >1000 Ohms
Input Level:	200 mV to 6.0 V. base-to-peak
Input Level Measurement:	200 mV to 6.0 V. ±50 mV base-to-peak or -23 dBdsx to +3 dBdsx ±1 dB
DS-1 Output:	1.544 Mbps ±40 bps (Stratum 4) in INTERNAL Clock mode. Output rate equal to input rate in LOOP-TIMED mode
Frequency Skew:	Output frequency can be shifted by 100 bps in INTERNAL Clock mode to verify far-end loop-timed status
Output Pulse Level:	3.0 V. nominal base-to-peak into 100 Ohms resistive load
Output Imbalance:	Positive and Negative pulses are within 0.2 V. base-to-peak
Channel Selection:	Any one of 24 selectable from keypad
PCM Supervision Displays:	40 character vacuum fluorescent display shows A and B bit signaling states for all 24 channels (Option Menu #: 20) simultaneously. In ESF mode A, B, C and D bits are displayed. 4 LED's show status of on/off-hook supervision of selected time slot
Operating Modes:	TERMINATE: selected channel is connected to channel generator and receiver. Other 23 channels send IDLE code (7F) MONITOR: monitor selected channel in one or both directions. All 24 channels pass through unchanged. Framing is regenerated. DROP&INSERT: dual-direction only. Selected channel dropped out for testing. Other 23 channels pass through unchanged. (Option 930A-09E)
Pattern Simulation:	Idle Code (7F), Received PCM Optional patterns require Option 930A-22 Bit Error Rate testing
Frame Loss Criteria:	Loss of frame occurs when 2 out of 4 Ft bits are in error for Superframe and SLC-96. Loss of frame for ESF occurs when 2 out of 4 FPS bits are in error
Error Displays:	Detects and counts Frame Errors, Bipolar Violations, Frame Slips and CRC Errors (ESF Only).
Alarms:	Sends Blue Alarm (All Ones) or Yellow Alarm (ALL Bit#2=0) on Superframe and sent on Facility data Link for ESF
Alarm Displays:	Detects and displays Frame Loss, Carrier Loss, Excess 0's, Yellow and Blue Alarm.

PCM Channel Encoder

Analog Tone Generation: 20 Hz to 3904 Hz selectable in 1.0 Hz steps from keypad

Tone Level: +3.0 dBm to -50.0 dBm in 0.1 dB steps selectable from keypad

Frequency Response: ±0.1 dB (20 Hz to 3904 Hz)

Basic Accuracy:

Accuracy	Level
±0.1 dB	+3.0 dBm0 to -30 dBm0
±0.2 dB	-30 dBm0 to -40 dBm0
±0.5 dB	-40 dBm0 to -50 dBm0

Supervision: NORMAL (E&M), USER DEFINED states of A and B bits (C and D bits in ESF).
FXO/FXS simulation (Option 930A-25)

Signaling: MF, DTMF and DP

PCM Channel Decoder

Recovered Analog Tones: 20 Hz to 3904 Hz ± 1 Hz

Recovered Level: +3.0 dBm to -40.0 dBm (Average and RMS)

Basic Accuracy: ±0.1 dB with Digital Milliwatt

Accuracy	Input Level
±0.1 dB	+3.0 dBm0 to -30 dBm0
±0.2 dB	-30 dBm0 to -40 dBm0
±0.5 dB	-40 dBm0 to -50 dBm0

Frequency Response: ±0.1 dB @ 204 Hz to 3904 Hz with 0 dBm applied.

Supervision: On-hook and Off-hook supervision are user definable as any combination of A, C and B, D bits (i.e., 0, 1, or "don't care").
FXO/FXS supervision available with Option 930A-25

Signal to Total Distortion:

Input	7 5/6 Signaling	CCIS
0 to -30 dBm0	38 dB	40 dB
-30 to -40 dBm0	36 dB	36 dB
-40 to -50 dBm0	32 dB	32 dB

Gain Tracking Error:

Input	Max. Deviation
+3.0 to -30 dBm0	±0.1 dB
-30 to -40 dBm0	±0.2 dB
-40 to -50 dBm0	±0.5 dB

Intrinsic Noise: 10 dBrnC (with Idle Code received)

Phase/Amplitude Jitter and Hits (Option 930A-18)

Phase and Amplitude Jitter Measurements

Received Holding Tone Level:	+10 dBm to -40 dBm (Metallic) 0.0 dBm to -40 dBm (PCM)
Holding Tone Frequency Range:	990 Hz to 1030 Hz
Phase Jitter Measurement:	0.0o to 30.0o peak-to-peak
Accuracy:	±5%, ±0.2o
Amplitude Jitter Measurement:	0.0% to 30.0% peak
Accuracy:	±5%, ±0.2%
Weighting Filter Bandpass:	4 Hz to 300 Hz, and 20 Hz to 300 Hz

*Transients (Hits) Measurements**

Phase Hits:	5o to 50o peak in 1o steps
Gain Hits:	±1 to ±10 dB in 1 dB steps
Dropouts:	Tone level drops below 12 dB ±1 dB
Guard Interval:	Per IEEE STD. 743-1984 Figs. 6 and 7
Timer:	Same as Impulse Noise
Count Rate:	Same as Impulse Noise
Counter Capacity:	Same as Impulse Noise

Purchased Option 930A-18 requires that *Purchased Option 930A-07, Impulse Noise* be installed as well. The Impulse Noise counts are interlocked with the transient measurements in accordance with IEEE specifications.

Envelope Delay Distortion (Option 930A-19)

Modes:	SEND and REPEAT (Master and Slave)
Transmitter:	50% AM signal at modulation frequency of 831/3 Hz
Carrier Frequency:	304 Hz to 3504 Hz ± 2 Hz
Carrier Level:	0.0 dBm to -40 dBm (Metallic), 0.0 dBm to -40 dBm (PCM)
Flatness:	±0.2 dB (304 to 3504 Hz)
Receiver Input Level:	+10 dBm to -40 dBm (Metallic) 0.0 dBm to -40 dBm (PCM)
Distortion Measurement Range:	+9000, -3000 µseconds
Accuracy:	±10µs 604 Hz to 3504 Hz, ±30µs 304 Hz to 603 Hz

Intermodulation Distortion (Option 930A-20)

Transmitter Spectrum:	Four equal level tones (857, 863, 1372 and 1388 Hz)
Harmonic Distortion:	>35 dB below tone level
Transmitter Level Range:	0 dBm to -40 dBm RMS (Metallic), -6 dBm to -40 dBm RMS (PCM)
Accuracy:	±1 dB
Receiver Input Level:	0 dBm to -40 dBm RMS (Metallic), -6 dBm to -40 dBm RMS (PCM)
Distortion Products:	2nd Order centered at 520 and 2240 Hz, 3rd Order centered at 1900 Hz
Distortion Range:	10 dB to 70 dB below signal-2nd Order 10 dB to 70 dB below signal-3rd Order
Resolution:	1 dB
Accuracy:	±1 dB
Signal-to-Noise Test:	Removes Low Tone pair and increases level of remaining tone pair by 3 dB.

DS-0/DS-1 Bit Error Rate Testing (Option 930A-22)

DS-1 BERT Specifications

Input:	See Option 930A-08E/09E specifications
Output:	See Option 930A-08E/09E specifications
Framing:	Patterns may be framed (D4 or ESF) or unframed
Test Patterns:	Pseudo-random bit sequences (PRBS) of the following lengths may be sent and received: 29-1 (511) 211-1 (2047) 215-1 220-1 QRSS (220-1 with 14 zero suppression) 223-1
Stress Patterns:	3 in 24 bits (100010001000000000000000) 1 : 7 bits (10000000) 1 : 1 bits (1010) All 1's 55 OCTETS (440 bit pattern for Multiplexer Testing)
User-Defined Patterns:	User may input any bit sequence length from 1 to 24 bits (even numbers from 18 to 24). Pattern will continuously repeat
Loop-back Codes:	Send and Receive CSU loop codes: Loop-Up= 10000 continuous for 8 seconds Loop-Down= 100 continuous Other Loop codes can be sent and received by editing the above patterns
Error Injection:	Inject single logic errors, bipolar violations, frame errors (D4 mode) or CRC errors (ESF mode)
PRBS Receiver Sync:	128 consecutive error-free bits must be received to achieve synchronization. BER of greater than 10-1 for 320 milliseconds causes sync loss and resync attempt
Pattern Sync:	386 consecutive bits with less than 10-2 error rate must be received to achieve pattern sync. BER of greater than 10-2 for 2 milliseconds causes sync loss and resync attempt
Measurements:	Measures and displays: Bit (Logic) Errors, Bit Error Rate, Bit Slips, Bipolar Violations (BPV), Frame Errors, Frame Losses, Frame Slips, CRC Errors (ESF mode), Errored Seconds, % Errored Seconds, Error Free Seconds, % Error Free Seconds, Severely Errored Seconds, % Severely Errored Seconds, Failed Seconds, % Failed Seconds, Unavailable Seconds, % Unavailable Seconds, % Availability, No PCM, Test Length, Clock Time/Date, Elapsed Time
Test Length:	Timed or continuous
Timed Test Length:	15 minutes, 1 hour or 24 Hours

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